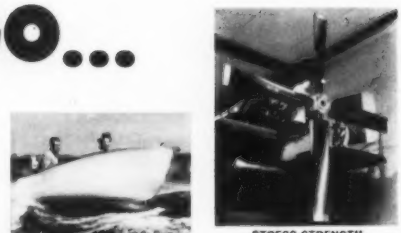
MODERN PLASTICS

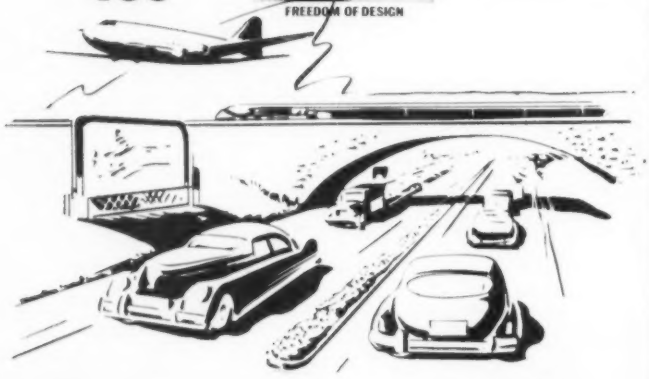
JULY 1953

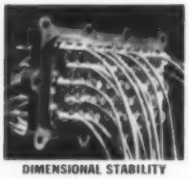
More GO... for your products too



STRESS STRENGTH

FREEDOM OF DESIGN





DIMENSIONAL STABILITY

ELECTRICAL PROPERTIES

with DUREZ PLASTICS

HEAT RESISTANCE

● Whatever way you travel today, your safety and comfort are usually furthered by the products of manufacturers who saw advantages in using Durez phenolic plastics.

In this there may be a cue for you. The products *you* have in mind . . . for development or for improvement . . . may "go" better and pay you more profit with the right combination of phenolics properties.

We have developed phenolics that serve with outstanding success under exposure to heat, cold, water, chemicals, impact and other mechanical stresses, and in some forms, abrasion. As molded parts they make it possible to cut production corners, step up manufacturing schedules. As resins they protect and often enhance important properties of rubber, wood, and various fabricated substances.

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PHENOLIC RESINS

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- INDUSTRIAL RESINS
- PROTECTIVE COATING RESINS

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Member S. P. I. Committee on Large Plastics Moldings

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(cast in green sand)

Shell molding success with MAGNESIUM

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(cast in shell molds)

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MODERN PLASTICS*

JULY 1953 VOL. 30, NO. 11

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Drum lined with Geon-based plastisol—used for shipping acid.

Unbeatable Drum for Acid

. . . can be used again and again!

THE plastisol lining in the drum pictured is a lifesaver for the drum—and a cost-saver for the shipper! The plastisol is made with Geon paste resin. It protects the metal against corrosion by sulfuric acid, ferric sulfate, sodium hypochlorite and other acids and corrosive chemicals. It permits use of ordinary metal drums, instead of breakable containers. And these plastisol-lined drums can be used over and over. Some have been on the job for three years! You can see how this Geon-based plastisol cuts costs.

Perhaps a plastisol like this can help you improve or develop products to make savings—to bring in more sales. For Geon-based plastisols can be used to coat, cast, mold or dip. They resist heat and cold, oils, greases, aging, abrasion and many chemicals. They require no expensive mixing equipment, no solvents, no recovery systems. For helpful, technical information on their uses, or on your specific requirement, please write Dept. GB-7, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors

all dressed up and ready to go places...

SYLVANIA'S NEW *Catalina* PORTABLE RADIO WITH CABINET OF

CHICAGO MOLDED *Plastics*

When you have a well engineered radio to start with . . . and then dress it up with a handsome cabinet of Chicago Molded Plastics . . . the result is something to shout about. And that's what folks are doing right now . . . plenty of shouting about Sylvania's new Catalina Portable Radio. It has genuine beauty . . . sleek, smart, stylish, in a half dozen eye-catching color combinations. It has strength, too . . . molded of sturdy heat- and impact-resisting polystyrene. And it's designed and engineered for economical mass production . . . and easy assembly.

This Sylvania job is a particularly fine example of plastics molding . . . yet typical of all Chicago Molded jobs. We set high standards here . . . and live up to them. We have the know-how that comes with 34 years of successful experience . . . plus the facilities for fast, economical molding of all plastics materials.

Perhaps you are considering the use of molded plastics in your product. If so, you'll find it a good idea to talk things over with a Chicago Molded engineer. Just write, wire or phone. There's no obligation.

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EDITORIAL

A New Power to Us!

From nuclear experiment stations in England and France as well as in the United States comes word of the first results of experiments in which plastics were subjected to radiation. And from a private industry here comes word of the bombardment of one plastic—polyethylene—with electrons.

These words are so startling in the case of polyethylene that the new technical horizons exposed by them almost stagger the imagination.

Briefly, under controlled irradiation this thermoplastic material becomes almost a thermoset while retaining its advantages of flexibility and low specific gravity. It means that squeeze bottles will stand up under steam sterilization, that polyethylene dishes may be boiled, that film can be made to take terrific heat.

The experimenters have also found that different types of irradiation may be used to turn liquid into solids and to alter the molecular structures of materials. This opens up new possibilities for the conversion of plastics resins into plastics products.

From laboratories in New England come the first rumors of fantastic experiments in which ultrasonics are being applied to plastics processing. Again, results are reported to be most remarkable.

These new sources of energy will help the plastics industry to step over the threshold into a fabulous new future, making more plastics possible, giving plastics even greater versatility than they now possess, and giving the industry new opportunities for usefulness.

The new technology will be slow to get into the literature because the experiment programs are vast and comprehensive, because patent situations in connection with them are rather hazy, and because development of equipment for use with the new processes will naturally lag behind the technology itself.

Nevertheless, it will behoove the chemists, mechanical engineers, and production men in the industry and among its end users to watch these developments carefully since five or ten years from now they may well become standard practice.

And since the rate of translation of new technology into practice and products depends on management, it is going to be necessary for management to spend more time in the study of these matters. The average executive's knowledge of even the simplest phases of nuclear science, of ultrasonics, and even of electronics is dangerously little. Conversely, the ability of the average scientist to impart information in lay language and thereby make it usable by management is just as small. Which is why industrial magazines are published.

MODERN PLASTICS will make every attempt to present to its readers the information concerning these new forms of energy and the means whereby they may be used as that information becomes procurable.

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Do it with the Heavy Duty, All Steel

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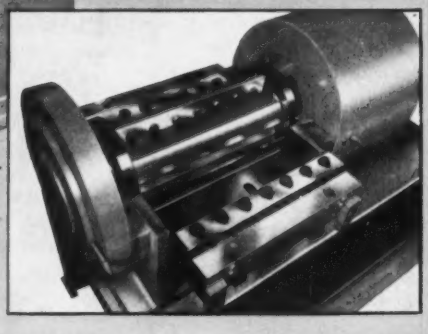
with the 8"x20" Throat Opening



Dismantled view of cutting head (right) shows compact, efficient design.

FEATURES RUGGED CONSTRUCTION including all-steel weldments with deep welds and extra-large fly wheel for heavy blows. Prevents machine stalling!

HANDLES MANY MATERIALS including cylinder purgings, "bleeder scrap", heavy cast slabs of polystyrene or acrylic resins.

NO PRIOR BANDSAWING NEEDED because machine is specially built to handle most bulky plastic parts (which are too difficult to process on conventional machines).

PREVENTS SERIOUS "WRECK DAMAGE" if foreign object should be dropped in machine. Rugged construction solves this problem.

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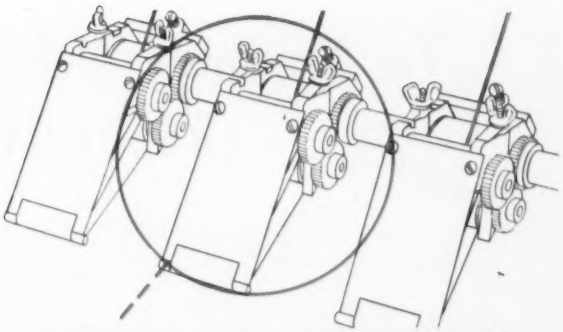
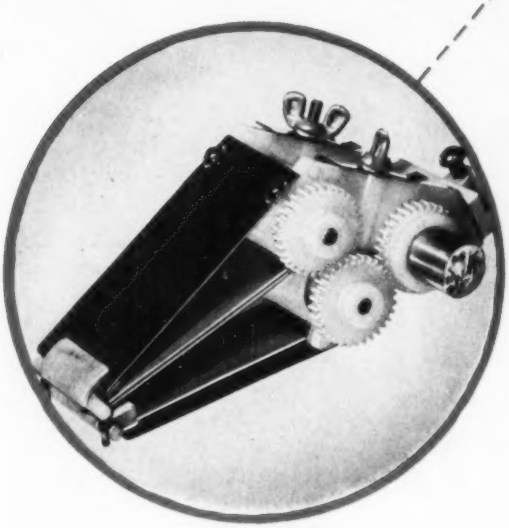


Parts of Du Pont nylon stop yarn contamination



Parts molded for
Macdonald and Sons, Inc.,
by Plastic Mold and Engineering Co.,
both of Providence, R. I.

in textile spinning process, need no lubrication, last longer, improve yarn quality

In the textile industry, long draft units—200 to 400 per machine—are used to finish rough yarn during the spinning process—give it strength and uniformity. The moving parts of these units have always proved troublesome. They wore and abraded . . . required oiling. Resultant yarn contamination was a constant problem. Maintenance required complete machine stoppages to remove and replace one unit. Production suffered . . . costs increased.

In designing an improved unit, as illustrated, Macdonald and Sons, Inc., overcame these problems and developed at the same time a unit that improves yarn quality. They specified that all moving parts and bearing surfaces be molded of Du Pont nylon. The nylon parts need no lubrication, yet they resist abrasion and actually outwear their counterparts by several times. Du Pont nylon is tough . . . does not chip or crack . . . can operate continuously to 250°F. It absorbs shock . . . damps noise and vibration. And nylon's strength and resiliency allow the operator to remove and replace units while the machine is operating, without damage.

Du Pont nylon helps produce a better yarn, free of contamination. Costs are lowered . . . production is increased.

Perhaps Du Pont nylon's unique combination of properties can help you improve a product or a process. For full information, write: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 307, Du Pont Bldg., Wilmington 98, Delaware.

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BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY
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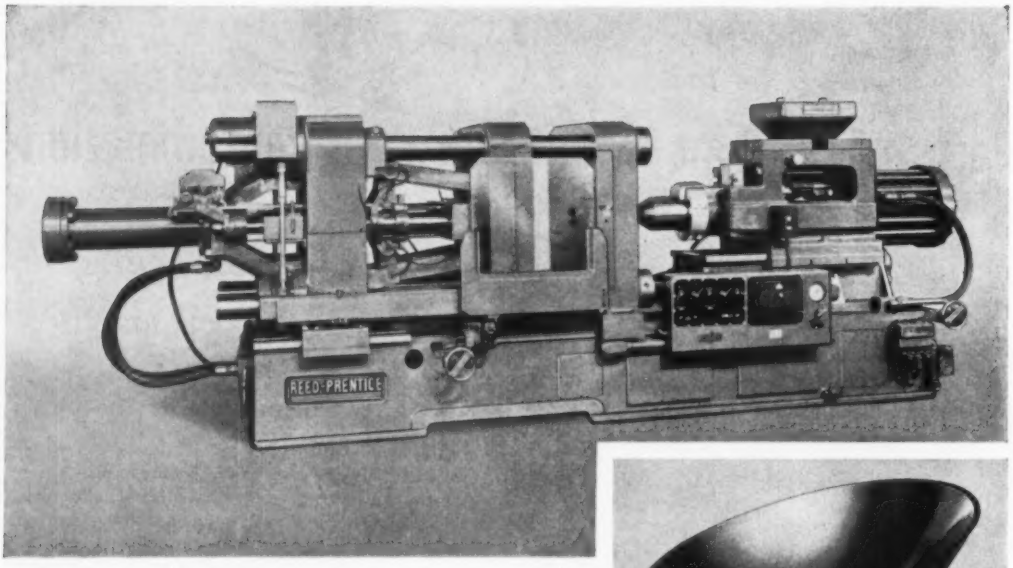
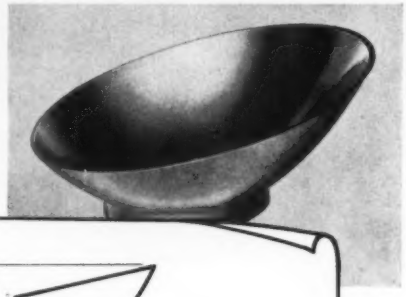
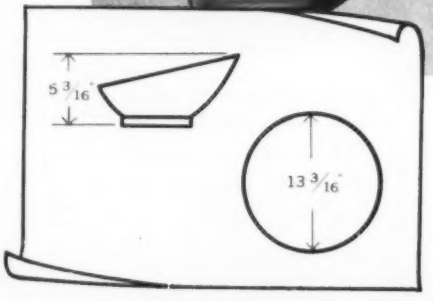
For Maximum, High-Quality Molding . . . - the 600T-32 oz. "REED"





Molded of high-impact Bakelite C-11 plastic on a 600T-24 oz. "REED", this large bowl weighs 20.8 oz. and is a product of the Jim Robbins Co., Hazel Park, Mich.



With a reliable Reed-Prentice 600T-32 oz. injection molding machine in your plant, you can count on high-quality, trouble-free molding. This 600T-32 oz. press offers:

1. Long stroke for deep-draw jobs — 24 inches
2. Large die plates for more casting area — 45 x 54"
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5. Rugged tie bar construction — 6" dia. tie bars
6. Fast cycles for rapid production — 100 shots per hour — max.

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This organization will make available to industry the benefits of its development work in molding, laminating and advanced fabricating techniques. If you are now using or planning to use polyester resins in your product manufacture, you are invited to call on us immediately for technical and practical help. Celanese can give you technical assistance in Los Angeles, San Francisco, Dallas, St. Louis, Chicago, Cleveland, New York, Atlanta, Georgia and Leominster, Mass. Celanese Corporation of America, Plastics Division, Marco Resins Department 101-G, 290 Ferry Street, Newark 5, New Jersey.

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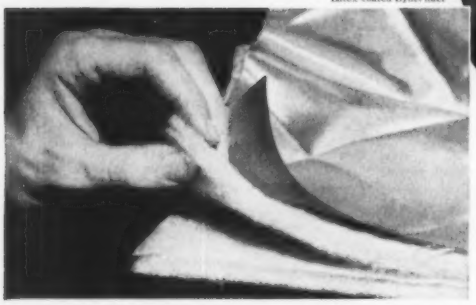
Celanese* PLASTICS

Another new development
using AMERICAN ANODE *materials*

Untreated Dynel

Latex-coated Dynel fiber



"Stratojac" made by Winer Manufacturing Co., Inc., Hammond, Ind. "3-D" Dynel insulation made by Fiber Bond Corp., Chicago, Ill. American Anode supplies the latex only.*

Zero knocked for a loop
BY NEW INSULATION

Synthetic fiber coated with latex gives lots more warmth with less weight

THIS jacket you see, known as "Stratojac", is notable for its great warmth plus its light weight. That's because of the new "3-D"* (three dimensional) Dynel insulation, a new development using American Anode latex and Dynel synthetic fiber.

Each strand of Dynel is coated with American Anode latex and fluffed into insulation that has these amazing properties. Besides being lighter than wool and warmer, it is tough. It can be crushed, sat on, rumpled and comes back as good as new. Not harmed by dry-cleaning solvents. It has fine "hand" and won't mat ever. This insulation can also be used in pillows, as packaging material, with many more uses.

Finding the right material to help do this job is typical of American Anode's approach to many problems. For American Anode materials and techniques have helped produce such successes as decontamination boots, dust-proof helmets, a method for printing on rubber, foam pads for truck seats and a host of other products used in industry and the home. Perhaps an American Anode latex, resin paste or other material can point the way to the development of a saleable idea or the improvement of a product for you. We'll help with technical advice. Please write Dept. AD-4, American Anode, 60 Cherry Street, Akron, Ohio.

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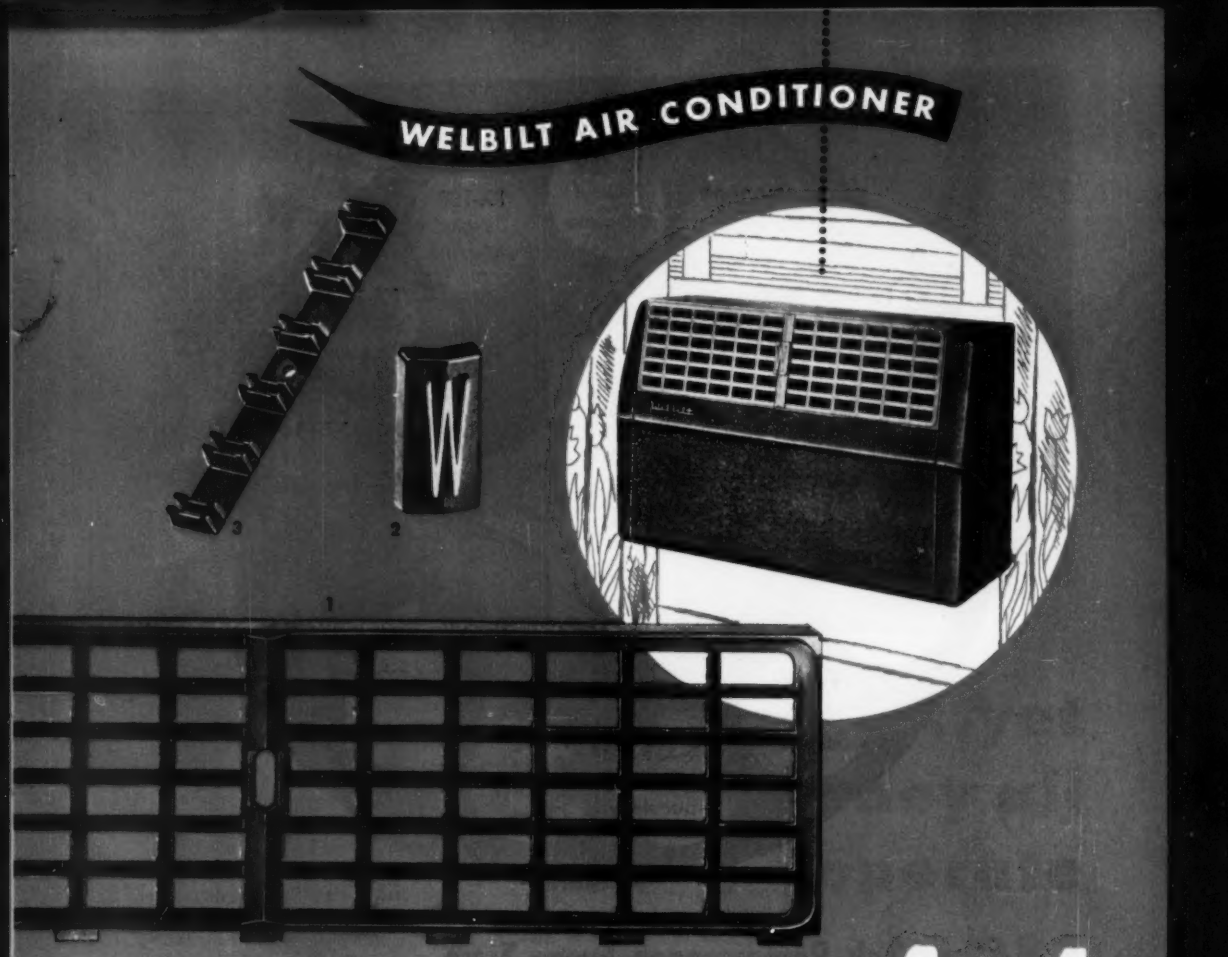
CRUDE AND AMERICAN RUBBER LATICES, WATER CEMENTS AND SUSPENSIONS, AMERAN RESIN PASTES, COMPLETE MANUFACTURING FACILITIES



with plastic parts by Ideal

It's uncomfortably hot. Push the switch. Now it's pleasingly cool. . . . That's the story of the Welbilt Zephr-trol Air Conditioner made by Welbilt Stove Co., Inc., Maspeth, N. Y., with impact styrene plastic components carefully injection molded by Ideal Plastics.

Whether plastic parts require streamlined styling for combined utility and beauty (such as the grille (1) and grille knob (2) above) or merely rugged utility (such as the claw plate (3) above), Ideal injection molds them to perfection.

You stand to benefit when you have Ideal do your custom injection molding, because Ideal operates one of the largest, best-equipped molding plants in the country. This plant has everything . . . every facility a molder could possibly need for moldmaking, molding, assembling, decorating, fabricating, and finishing. This wealth of fine equipment, plus an unusual record of successful custom molding for critical customers, is what attracts so many leading users of plastics to Ideal.

Discuss the details of your next injection molding job with Ideal. You'll be glad you did. Contact A. C. Manovill, Vice Pres. in Charge of Sales for details. Ideal Plastics Corporation, 184-10 Jamaica Ave., Hollis 7, N. Y. Phone: AXtel 7-7000. Midwest representative, Steel Mill Products Co., 176 West Adams St., Chicago 3, Illinois. Phone: CEntral 6-5136.

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...yet they all operate MPM extruders

Because they often lack first class service and maintenance facilities, plastic manufacturers in such farflung cities as Lisbon, Athens and Shanghai, to mention a few, must be absolutely certain of the reliability of the machinery they purchase. That is one of the prime reasons why so many of them favor MPM extruders and auxiliary equipment.

The MPM features which impress out-of-country buyers are important to purchasers in the United States, too. MPM's vari-speed drives, for instance, can, without strain, provide ample power to mix components adequately and to extrude extremely heavy cross-sections that are dimensionally true. The screws, cylinders, die heads and other parts of MPM extruders that are normally subject to wear are made of corrosion and abrasion resistant metals in solid sections, rather than platings. Throughout, every MPM extruder is built to serve for years and years.

The places you find MPM extruders in operation are almost as diversified as the range of products being made on them . . . tiny monfilaments to blown film a hundred inches wide, covered electrical wire to irrigation pipe. And the MPM heating system is so flexible that these products are being extruded of just about every known thermoplastic.

What is the conclusion to be drawn from all this? Simply: wherever your plant is located, whatever you want to extrude . . . give full consideration to MPM equipment. It's good business.

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(West Coast Representative)
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THE DOWDING AUTOMATIC *FAST-CYCLING*

INJECTION MOULDING MACHINE

Phenomenal Demand— Extends Manufacturing Programme!

- 1,200 CYCLES PER HOUR
- FULLY AUTOMATIC AND FOOLPROOF
- FAST PLASTICIZING AT UNUSUALLY LOW INJECTION PRESSURE
- AUTOMATIC LUBRICATION
- 3-ZONE CYLINDER HEATING
- VICKERS DETROIT HYDRAULIC EQUIPMENT

BRITISH MADE

EARLY DELIVERY

SPECIFICATION

MACHINE CYCLES PER HOUR (Max.)	1200
APPROXIMATE WEIGHT OF MATERIAL PLASTICIZED PER HOUR (Dependent upon weight per shot and material used)	22 lb.
Area of Injection plunger	2·074 sq. in.
Pressure per square inch on material at end of plunger	9100 lb.
Total pressure on Injection plunger	18,850 lb.
Mould opens (adjustable)	6-9 in.
Maximum die space	7½ in.
Minimum die space	3⅜ in.
Maximum recommended casting area in mould	15 sq. in.
Size of die plates	16 x 10 in.

DOWDING & DOLL LTD GREYCOAT STREET, LONDON, S.W.1

TELEPHONE: TATE GALLERY 9431 (10 LINES) TELEGRAMS: ACCURATOOL, SOWEST, LONDON

New Polyester Resins For Reinforced Plastic Molding

PARAPLEX P-47
PARAPLEX P-49

- Fast curing cycles
- Excellent mold release
- Strength and rigidity at elevated temperatures

Two new molding resins—PARAPLEX P-47 and PARAPLEX P-49—provide these much-desired properties. The resins fit into fast production cycles without cracking or crazing in resin-rich areas. They release readily from hot molds, and possess high strength and rigidity at elevated temperatures. Surfaces are tack-free when cured exposed to air.

Both resins have these important properties. They differ only in hardness and toughness—PARAPLEX P-47 is outstanding in its impact strength, while PARAPLEX P-49 gives optimum rigidity. Where even greater impact strength or flexibility is needed, both resins can be modified by the addition of PARAPLEX P-13, a very flexible polymer.

For details regarding these new resins, write for descriptive literature and a sample.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

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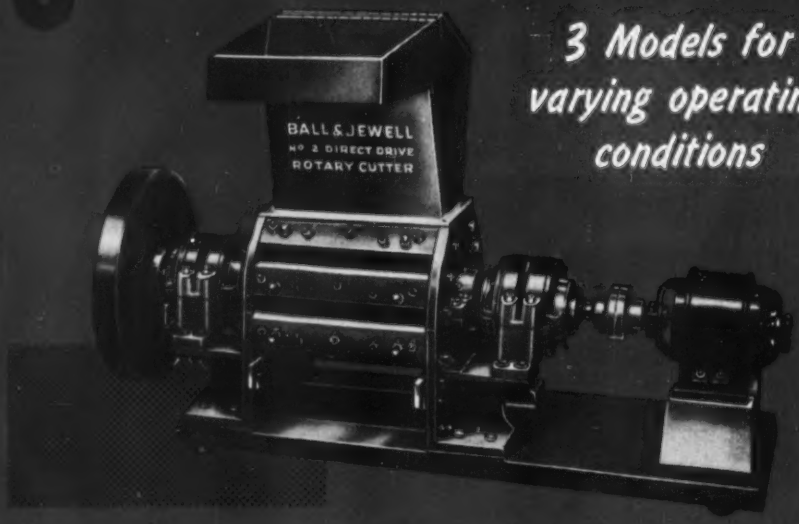
PARAPLEX is a trademark, Reg. U. S. Pat. Off. and in principal foreign countries.

For Heavy Duty Grinding

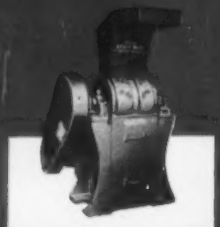
B&J NO. 2 GRANULATOR



3 Models for varying operating conditions

IDEAL GRANULATORS FOR AVERAGE GRINDING

STANDARD IDEAL
for accumulated average scrap. Capacity: To 250 lbs. an hour. 2 or 3 H.P. motor.



HEAVY DUTY IDEAL
for accumulated scrap of the toughest materials and small bleeder scrap. Capacity: To 250 lbs. an hr. 5 H.P. motor.

Here's the B & J granulator — the largest and sturdiest grinder on the market today — used by all the leading plastic material manufacturers and scrap dealers. Wherever virgin slab, large lumps, purges or large rejects must be granulated, you will find the B & J #2 gives dependable service, with capacities up to 1,500 lbs. per hour.

The B & J #2 is available in three models: #2-28"— 28" x 10" throat opening, #2-18" — 18" x 10" throat opening, #2-12" — 12" x 10" throat opening, to meet the requirements of varying operating conditions. The #2-28" is our largest and most popular high production grinder. #2-12" and #2-18" are recommended for the largest and toughest lumps, purges or bleeder scrap. All are sturdily built for long, trouble-free operation.

In the B & J line, there is a granulator to meet every need. Tell us your requirements and send samples of your material for grinding in our testing laboratory. Or, write for brochure describing our many various size machines.

REMEMBER, B & J GRINDERS COVER THE ENTIRE PLASTIC INDUSTRY

BALL & JEWELL, INC.

Squeeze Play on Plastics

modernfold DOORS

ACCORDION DOORS--

Pulled by Handles-- Rolled on Trolleys

by KURZ-KASCH

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This successful company with its unique contribution to a brighter plan of living has depended on Kurz-Kasch for its moulded plastics for over a decade. We have contributed, too—sound advice on *proper* plastics applications; sensible tooling; economical production—in short, everything it takes to earn a reputation as a solid source of supply. Want to try us? For information or a proposal, just write or phone.

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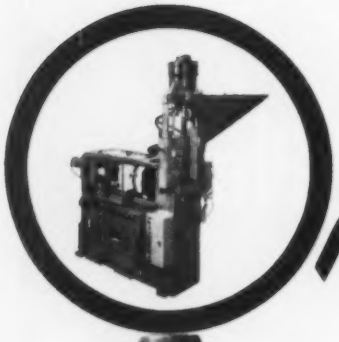
Kurz-Kasch

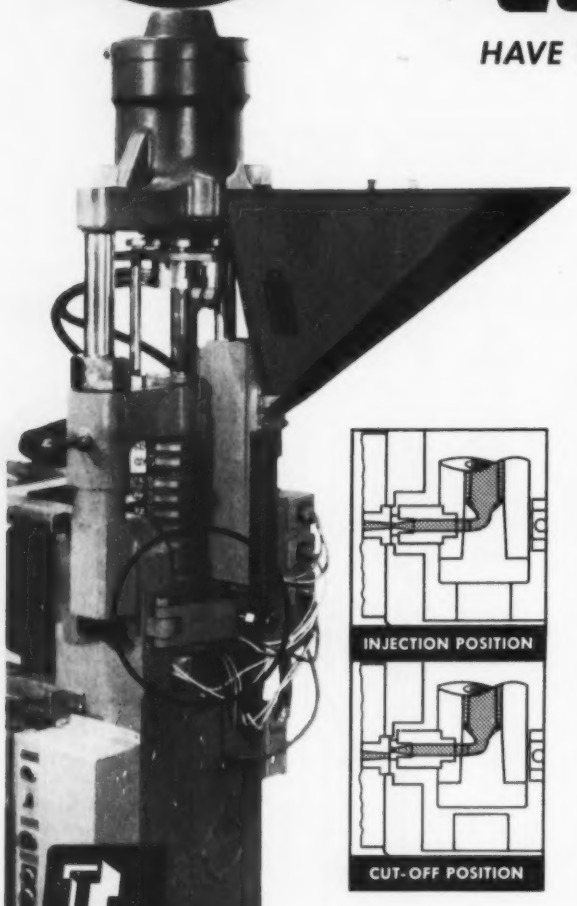
FOR OVER 36 YEARS PLANNERS AND MOULDERS IN PLASTICS



Only LESTERS

HAVE THE PATENTED, TIME-TESTED

NYLON CUT-OFF ATTACHMENT



Unlike other thermoplastics, nylon drools when heated. The Nylon Cut-Off Attachment on Lester machines is the *only* positive shut-off available for controlling this nozzle drool. No filter plates, no screen packs, no hypersensitive temperature control—*just routine injection molding!* Whether the part sticks, inserts are being loaded, or cavities are being lubricated—whatever the reason for cycle delay—the operator has no added anxiety about nylon drool and possible mold damage.

Here is a partial list of the many injection molders where, at this moment, tons of nylon are being molded on Lester 4, 8, 12, and 20 oz. machines using the Nylon Cut-Off Attachment:

Autograf Brush & Plastics Co. . Watervliet, Conn.
Canadian General Electric Co., Ltd. . Cobourg, Ont.
Central Molded Products Co. . . Chicago, Illinois
Danielson Manufacturing Co. . . Danielson, Conn.
Engineered Nylon Products . South Bend, Indiana
Foxval Molded Plastics Corp. . South Elgin, Illinois
Friden Calculating Mach. Co., Inc., San Leandro, Cal.
Nylon Molded Products Corp. . Garrettsville, Ohio
Prophylactic Brush Co. . . Florence, Massachusetts
Quinn-Berry Company . . . . Erie, Pennsylvania
Sinko Tool & Manufacturing Co., Chicago, Illinois
Waldes-Kohinoor, Inc. . . Long Island City, N. Y.

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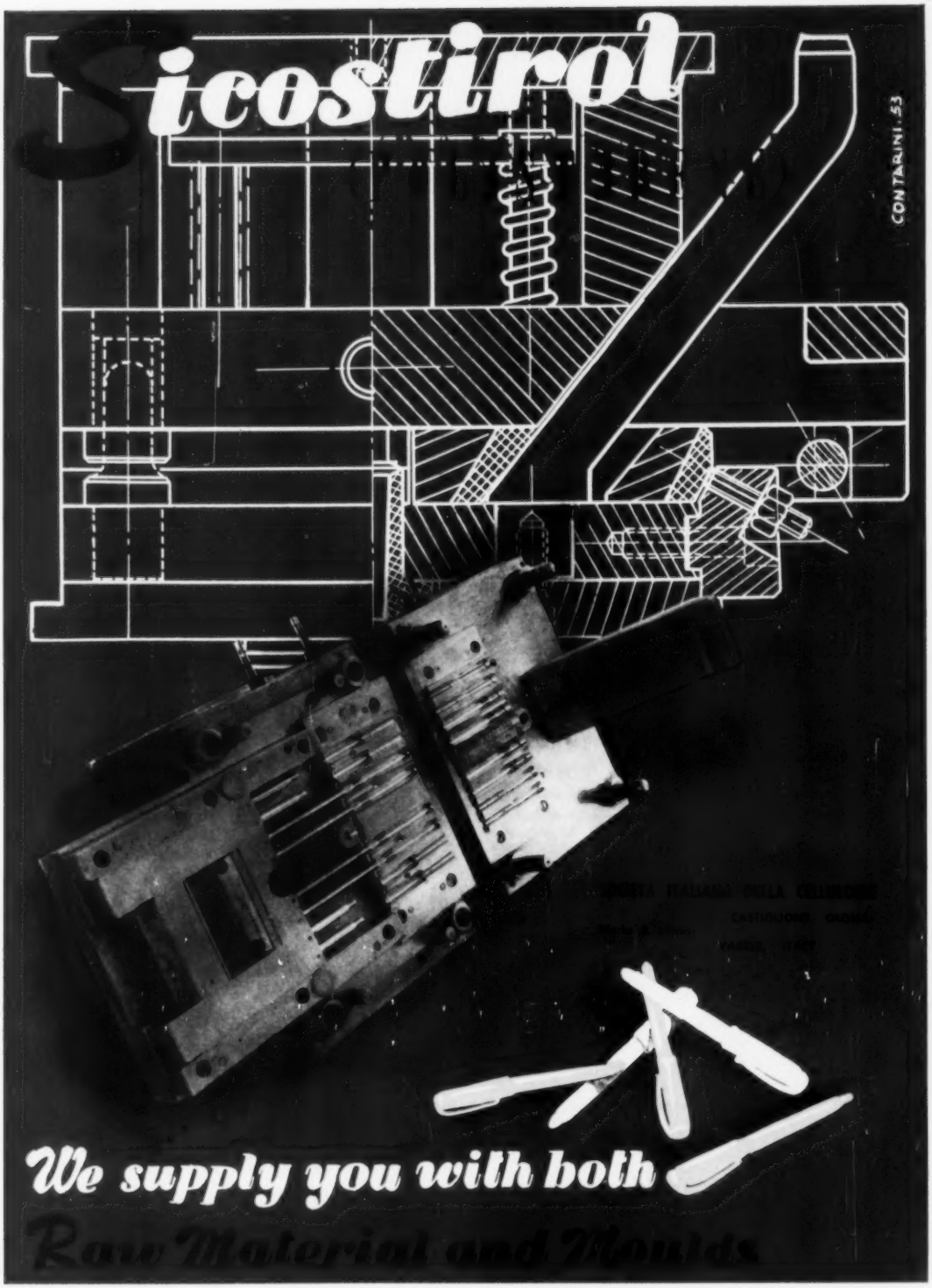
Sicostirol
CONTARINI 53
We supply you with both
Raw Material and Moulds

Repco Panels

are made to withstand a HURRICANE!

Can you think of a more rigid test to evaluate their durability? In the heart of the hurricane belt, at the University of Miami, these panels in the 1/16" thickness passed the hurricane test without damage. Conditions that prevail during the worst storms were simulated . . . winds and gusts ranging up to 135 miles per hour . . . coconuts, shingle and barrel roofing tile were induced into the air stream as well as water equal to one month's average rainfall. This was the result, briefly, in the words of Dr. H.H. Sheldon who directed the tests:

"At the conclusion of the tests the panels were carefully examined and found to be in excellent condition."

Uses: PROTECTIVE STORM WINDOWS • PERMANENT AWNINGS, SKYLIGHTS AND GREENHOUSES • colorful PARTITIONS AND COVERINGS FOR PATIOS AND BREEZEWAYS • WINDBREAKS • REPLACEMENT FOR WINDOW GLASS in factories, stores, offices and homes to eliminate glare, permitting soft light to enter • INTERIOR DECORATIONS • OUTDOOR LIGHTED DISPLAY SIGNS • for diffused lighting effects and hundreds of other uses.

in 4 types		in 6 thicknesses	in 10 colors
Type 7 TRANSLUCENT	Good light transmission	1/32", 1/16", 3/32", 1/8"	Sea Green, Coral Red, Sky Blue, Lemon Yellow, Wheat (clear)
Type 7A HIGH GLOSS TRANSLUCENT	Excellent light transmission	3/64", 3/32", 1/8"	Sea Green, Coral Red, Sky Blue, Lemon Yellow, White (clear)
Type S SEMI-OPAQUE	Glass fibers evident in surface	1/64", 1/32", 1/16", 3/32", 1/8"	Coral Red, Turquoise Blue, Lemon Yellow, Chalk White, French Gray, Mahogany Brown
Type 8 OPAQUE	Fillers added. Few surface fibers show		

Available in standard 36" x 96" or 48" x 96" sheets, Repco Panels may be trimmed into any size or cut into any shape to serve both functional and decorative purposes. Extremely light (the 48" x 96" panel in 1/16" thickness weighs only 16 lbs.), these panels are highly resistant to rust, rot, rodents, termites and weather . . . unaffected by extremes of heat, cold or moisture.

Write for folder and prices. Sample sent on request if you specify type.

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by Russell REINFORCED PLASTICS CORP.

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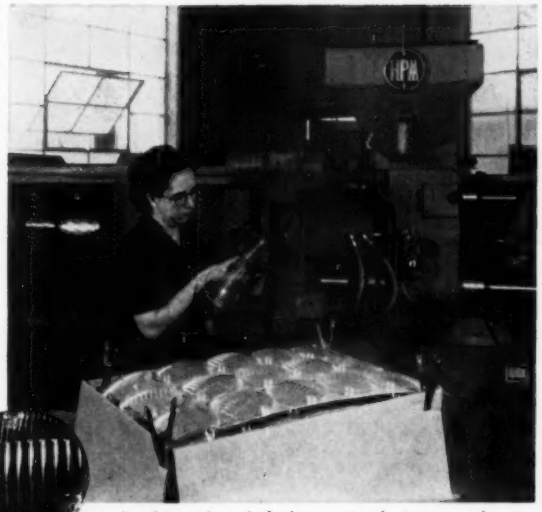
Representatives in LOS ANGELES • KANSAS CITY • TOLEDO • MIAMI • ATLANTA • TORONTO

Detroit Molder uses H-P-Ms for AUTOMOTIVE PARTS



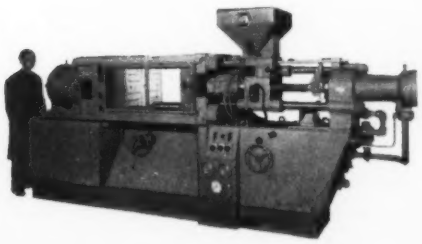
Acrylic parking light lenses weigh 4 ozs. each.

Butyrate auto arm rest . . . a 14 oz. "shot".

● Molding automotive parts is big business with Mercury Plastics and dependable machines are a must when automobile production lines are being supplied. That's why Mercury Plastics is a 100% H-P-M shop.

Look at these arm rests . . . this 14-oz. "shot" is a sample of the complicated parts molded on their H-P-M 16-oz. machines. The parking light lenses and many other small parts are being turned out by the thousands on their H-P-M "9s".

Regardless of the molding problem, molders know they can count on dependable H-P-Ms. They're fast and incorporate all the features you've been looking for . . . direct acting hydraulic mold clamp for quick mold set-up . . . improved feeding mechanism . . . faster plasticizing chamber . . . plenty of mold mounting space with long stroke available for deep parts. For easy accessibility, H-P-M pumps, valves and piping are mounted on the outside of the machine frame. Write for details, today!



HPM

THE HYDRAULIC PRESS MFG. CO.

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Presses For Every Pressure Processing Application

Photos courtesy of: Bakelite Co. & Durez Plastics & Chemicals, Inc.

Metasap* Stearates

provide

superior lubricants in molding compounds

If you must meet competition with quality molded products, and yet keep a tight rein on costs, you'll find no greater aid to profitable production than Metasap Stearates.

These metallic soaps provide outstanding lubrication—whether incorporated into molding compounds or dusted onto surfaces of mold cavities. Using them, you will eliminate preform delamination and breakage of finished products, *because ejection pressures will be reduced to a minimum.*

We particularly recommend:

Metasap Zinc Stearate
Metasap Calcium Stearate

For unusually intricate mold designs, and precision fabrication, this excellent lubrication will prove especially advantageous.

outstanding thickeners for plastisols

If you manufacture plastigels, you'll find Metasap Stearates top-notch gelling agents. Moreover, the *ready availability* of these scientifically prepared metallic soaps and the *basic economy* they afford are factors which help cut production costs—enable you actually to save money without sacrificing quality.

We'll be pleased to supply you with *free* samples of:

Metasap Magnesium Stearate **Metasap Barium Stearate**
Metasap Calcium Stearate **Metasap Aluminum Stearate**

—so that you may select just the thickener, or thickeners, you require for the plastisols you are handling.

*Reg. U. S. Pat. Off.

For complete information, write

METASAP CHEMICAL COMPANY (Dept. M), HARRISON, N. J.

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Stearates

of Calcium • Aluminum • Lead • Magnesium • Zinc

Our wide range of quality controlled phenolics embraces a combination of properties suitable to almost any application. To solve production problems... improve product performance... or add sales appeal...look to Plenco for the *right* plastic!

Phenolic thermosetting molding compounds are produced in general purpose grades and materials with special impact strength, heat resistance, or properties for deep drawing of large castings. Special purpose molding compounds in blacks, browns, mottles and other colors for particular molding requirements.

we supply the right combination

Phenolic synthetic resins are manufactured in dry, lump and finely ground particle sizes, or in solution adaptable to the application. Plenco engineers are available to help insure the success of a product through the stages from research to application.

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FOR BETTER PLASTIC PRODUCTS

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REQUIRE PRECISE TEMPERATURE CONTROL?

Thermo Electronic TEMPERATURE CONTROLLERS

provide
NULL BALANCE ACCURACY
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AND SPEED

AT LOW COST

Now, with Thermo Electronic Controllers, thermocouple and resistance bulb types, you can afford accurate, automatic temperature control on processes and equipment operating between −100°F and 3000°F. The two-position control action is continuous and high speed, only one part—a magnetic control relay—moves positively when the process calls for a change of heat. Both types of controllers incorporate a null balance circuit for high measuring accuracy with an electronic control system for sensitivity and speed. Calibration is guaranteed to within plus or minus ¼ of 1% of full scale range. Bright signal lights indicate temperature conditions and are clearly visible over wide angles and great distances.

Outstanding features of Thermo Electronic Controllers are simplicity of design and sturdy and compact construction. They are easy to install, economical to operate, and require little maintenance. Severe vibration or mechanical shock will not affect the measuring accuracy or control sensitivity.

TELL US ABOUT YOUR TEMPERATURE CONTROL PROBLEM OR WRITE FOR

Thermocouple Pyrometer Controller Bulletin 50P
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Thermo Electric Co., Inc.
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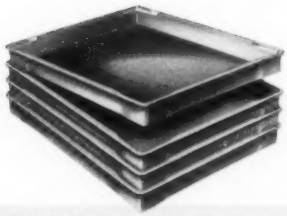
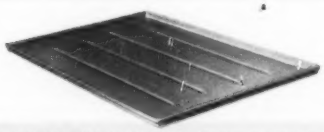
Spotlight on Value

Fiberglass-Reinforced Plastics Custom Molded by Fabricon



FIBERGLASS CAPSULE TRAYS, 31" x 25" x 3". Surface perfectly smooth to avoid damage to capsules. Design allows nested stacking.



BREAD TRAY, 35" x 24" x 1". Light yet durable, easy to clean. Thousands of these trays are cutting costs in progressive bakeries everywhere.

STACKING TOTE BOX for production parts. Light, deep, strong, stacks neatly out of the way. Ideal for storing and transferring small parts.

Yes, you'll find real *value* in fiberglass-reinforced plastics, molded to your order by Fabricon! Use them as efficient, cost-cutting equipment in your production and handling operations . . . or as sales-building component parts of your end products. Benefits include: • Light weight • Excellent strength characteristics • Ease of cleaning • Brilliant, permanent, molded-in colors • High corrosion resistance • Ability to withstand temperature extremes • Choice of the appealing natural texture of fiberglass itself, or a perfectly smooth surface • Heavier design of cross sections, where a combination of structural strength and light weight is desirable.

But to get the most out of versatile fiberglass-reinforced plastics, take advantage of our extensive background in research, product design, tooling and production. Present molding capacity up to 38" x 54" with 60" daylight, preform capacity for parts up to 48" diameter, 24" deep. However, much larger equipment for both processes will be available in the very near future, so regardless of the size or shape of the molding you need, get in touch with us now! Send parts, prints, or details of your problem for prompt engineering recommendations and a firm quotation.

FABRICON PRODUCTS, INC.
Plastics Division

Main Office: 1727 West Pleasant Ave., River Rouge 18, Michigan
Manufacturing Plants: River Rouge, Los Angeles
Sales Offices: New York, Chicago
Canadian Representative: Plastic Supply Co., Montreal and Toronto

NOTE: Fabricon is the world's largest producer of plastic-impregnated materials for the laminating industry under the trade name "Phenopreg." Phenopreg pre-impregnated fiberglass fabrics and mats are separate and distinct from the fiberglass materials used in our molding division.

Why Johnson Plastic Corporation Standardized on NRM Extruders

"No one could ask for better performance than we got from the three used NRM Extruders with which we founded our company," stated W. F. Miller, Jr., General Manager of Johnson Plastic Corporation. "Their production helped build our reputation for custom extrusions of quality and precision. Today, after two plant expansions, we operate many times this number of extruders, and are glad we standardized on NRM's.

The Johnson Plastic Corporation's preference for NRM Extruders is typical of plastic extruding companies everywhere . . . and like Johnson Plastic, where other makes have been operated side by side with NRM's, an overwhelming number of owners write: "We've standardized on NRM . . ."

If *you* are planning to purchase thermoplastic extrusion equipment, it will pay you to look into the NRM line TODAY. From NRM's *creative engineering* has come balanced heat control . . . the quick-opening die gate . . . the first electrically heated extruder, and many other features of superior NRM design and construction which result in extrusions of exceptionl precision and "texture." A post card brings full details, at no obligation.

In 1949, Johnson Plastic Corporation started in business with three used NRM Extruders. Today these machines are still working at top efficiency, along with the newer NRM's in this battery of extruders in Johnson's large, new plant at Chagrin Falls, Ohio.

2158

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For Exceptional Clarity in Films—
look to and through

PLIOVIC G80V

Properties of PLIOVIC G80V

Composition	100% Polyvinyl Chloride
Form	White Powder
Wet Sieve Analysis	100% through 40 mesh
Specific Gravity	1.40
Bulking Value	44 lb./cu. ft.
Intrinsic Viscosity	0.80
Solubility	Very Limited
Color	None
Taste	None

Here's picture proof—a 30 mil sheet of PLIOVIC G80V—fused at only 310°F. Note the glass-like clarity and complete absence of unfused particles.

Really different is PLIOVIC G80V—newest of the polyvinyl chloride resins by Goodyear.

Just introduced, PLIOVIC G80V is already setting new standards for fast, easy processing and exceptional film clarity at low temperatures. Processing and fusion temperatures as low as 310°-330° F. give increased production at decreased cost – without sacrifice of film quality.

PLIOVIC G80V is carefully polymerized to give the exact molecular structure and weight needed for rapid fluxing. It also is designed to resist heat and light, should extended processing or higher temperatures be used.

Films and sheeting made with PLIOVIC G80V have good physical properties and fabricating characteristics. Where desired, soft stocks for easy coating of fabrics and excellent penetration between fibers are readily produced.

Take a look at the properties of PLIOVIC G80V, then write for samples. Ask also about PLIOVIC G90V. Write to:

Goodyear, Chemical Division, Akron 16, Ohio

Chemigum, Pliobond, Pliolite, Pliovic—
T.M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

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Use-Proved Products — CHEMIGUM • PLIOBOND • PLIOLITE • PLIOVIC • WING-CHEMICALS — The Finest Chemicals for Industry

make it Wellington Sears "Lantuck"

a superior non-woven fabric for coating

Offering balanced strength in all directions due to its completely random distribution of fibers, Lantuck, Wellington Sears non-woven fabric, also provides smooth surface and high gauge-weight ratio at reasonable cost. It assures improved stitch and tear strength without interfering with the vinyl film's soft, pliable hand, so important in upholstery applications. The random fibers are bonded with a resin especially selected for use with vinyl coatings to give maximum strength and flexibility.

Lantuck is now made in 54 and 56 inch widths for coating and in weights of about three to four ounces per square yard.

Other Wellington Sears fabrics for coating and laminating are listed at right and are available in standard and special constructions from the "headquarters for industrial fabrics."

An illustrated 24-page booklet filled with valuable facts on fabric development and applications of interest to present and potential users of industrial fabrics is yours for the asking. Write for a free copy of "Modern Textiles for Industry" to Wellington Sears Co., Dept. J-5, 65 Worth Street, New York 13, New York.

Superior Fabrics for Coating and Laminating

Single filling ducks
Army ducks
Single and plied-yarn chafers
Special ducks
Sateens
Twills
Broken twills
Drills
Sheetings
Nylon, rayon and other synthetics
Lantuck non-woven fabrics

Wellington Sears

A SUBSIDIARY OF WEST POINT MANUFACTURING COMPANY

FIRST In Fabrics For Industry

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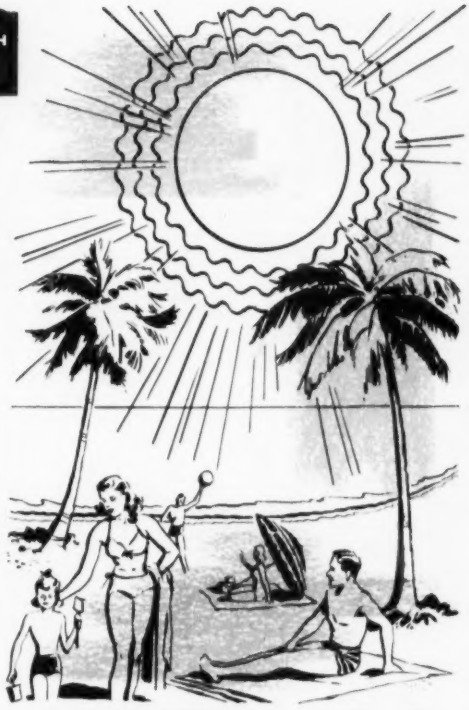

STABELAN HR

For Excellent Heat and Good Light Stability . . .

In Polyvinyl Chlorides and their copolymers STABELAN HR will serve as a "single package" stabilizer for high heat resistance plus good light stability . . . It is a synergized and chelated cadmium and barium compounded stabilizer which disperses easily in dry preblends, solutions and dispersions . . . It has been used with marked success in stabilizing all classes of organic and inorganic pigments — even delicate tints of organic reds and maroons.

STABELAN E

For Excellent Light and Good Heat Stability—Non-Plating on Rolls . . .

In Vinyl Plastisols, Organosols, Emulsions, as well as regular vinyl milled and calendered films, STABELAN E will provide a better stabilizer for ultra-violet and outdoor aging . . . It is a paste-form stabilizer that gives excellent light fastness and good heat stability, improves the transparency of clear films and gives films that do not "blush" and do not absorb water . . . It is compatible with all tested pigments — even organic reds hold their hue and age well when used with STABELAN E.

Mail this coupon today for Complete technical data on these stabilizers →

HARWICK STANDARD CHEMICAL CO.

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Send complete technical information on STABELAN "HR" and "E" to—

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How many custom molders' reputations lie buried here?

FIT THE RIGHT TYPE FASTENER TO THE JOB, ***NOT*** THE JOB TO THE FASTENER

TYPE Z

HEX HEAD Z

TYPE F

TYPE F-Z

TYPE U

When excessive breakage occurs in assembling plastic parts, who gets the blame? It's the custom molder, in too many cases, while the real culprit is the *wrong type* fastener.

If molding is your business, you can protect your reputation by consulting Parker-Kalon about fasteners before your customers' assembly lines get into motion.

If you are a manufacturer, get fastening recommendations from P-K before parts spoilage sends your planned profit to the scrap can.

The P-K ASSEMBLY ENGINEER is a fastening expert who is ready to help you plan how to save operations, simplify assemblies, add product strength. And, he'll show you how to make those planned savings *pay off* on the assembly lines. He'll call at your request, or, send specifications of your product for recommendations. Parker-Kalon Corporation, 200 Varick St., New York 14.

DELIVERIES ARE BETTER . . . SPECIFY P-K

Since P-K, the originator of the Self-tapping Screw, makes a complete line, recommendations are unbiased. Find out why so many fastener-wise manufacturers say, "If it's P-K, it's O.K."

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PARKER-KALON®

The Original **SELF-TAPPING SCREWS**

FOR EVERY METAL AND PLASTIC ASSEMBLY

5

important reasons why Shaw Insulator Company uses GENERAL ELECTRIC GENERAL-PURPOSE MOLDING COMPOUNDS

Shaw Insulator Company, Irvington, N. J., now uses General Electric 12490 (brown) and 12493 (black) general-purpose compounds to produce these molded plastics handles quickly and efficiently. Shaw benefits from:

1. **Maximum output**—because these G-E compounds are fast curing and rigid setting.
2. **Minimum inventory**—because their versatility permits their use in transfer and compression molding, and because G.E.'s shipping is fast.
3. **Reduced production costs**—fewer rejects because of their uniform pilling and loading characteristics, excellent flash release and flow control.
4. **Satisfied customers**—because the uniformity of molding characteristics and physical properties of these compounds helps keep quality high.
5. **Greater sales advantage**—because the high gloss finish imparted by G-E general-purpose phenolic molding compounds attracts new customers.

Find out for yourself how these five advantages of General Electric general-purpose compounds can help you turn out good looking plastics parts easily and economically. Just send the coupon today for technical data and free experimental samples

You can put your confidence in

GENERAL ELECTRIC

General Electric Company
Section 314-5A, Chemical Division
Pittsfield, Massachusetts

Please send me free samples ( ) and technical data ( ) on G-E general-purpose molding compounds.
I want this for:

- ☐ Reference purpose only
- ☐ An immediate application on _____

Name _____
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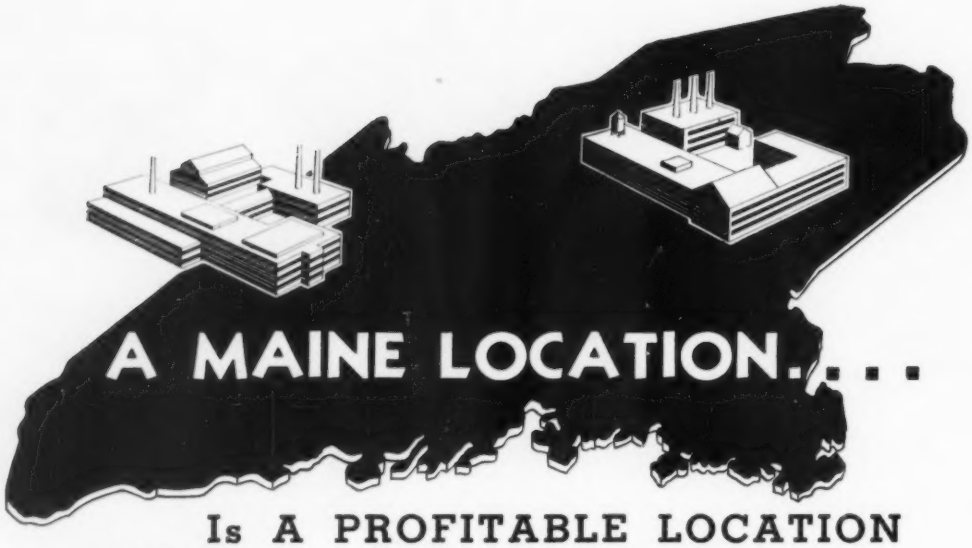

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Is A PROFITABLE LOCATION For Plastic Manufacturers And Fabricators

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GEARED TO THE PLASTICS INDUSTRY

- Experienced, Loyal Labor
- Exceptionally Fine Labor-Management Relations
- Favorable Tax Structure
- No State Income Tax
- Access to Major Markets
- Excellent Transportation
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- Abundant, Economical, Power Unlimited Natural Resources
- Good Schools and Colleges
- *And Maine is a grand place to live, to work, to play.*

The availability and stability of skilled Maine workers, - proximity to the nation's largest markets - excellent transportation facilities - nearby sources of supply including dies, wood pulp, wood flour, etc. - a favorable tax structure and no state income tax make Maine's industrial climate very favorable for the Plastics Industry.

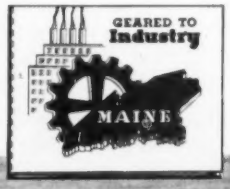
In addition, Plastic Manufacturers and Fabricators can take advantage of the

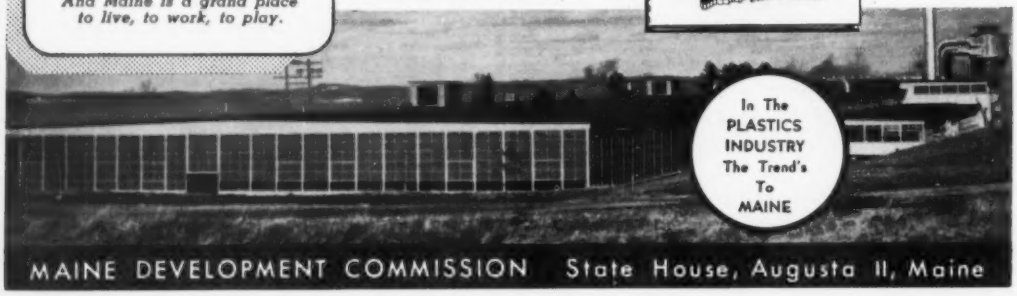
MAINE COMMUNITY PLAN

This unique cooperative idea makes available new modern factory space to your specifications on a long term, low cost basis.

Follow the lead of the leaders - find out how you can operate more successfully and more profitably in Maine. Our specially trained industrial engineers are at your service without cost or obligation. Your inquiry will be held in the strictest confidence. Write, wire or phone today - Now!

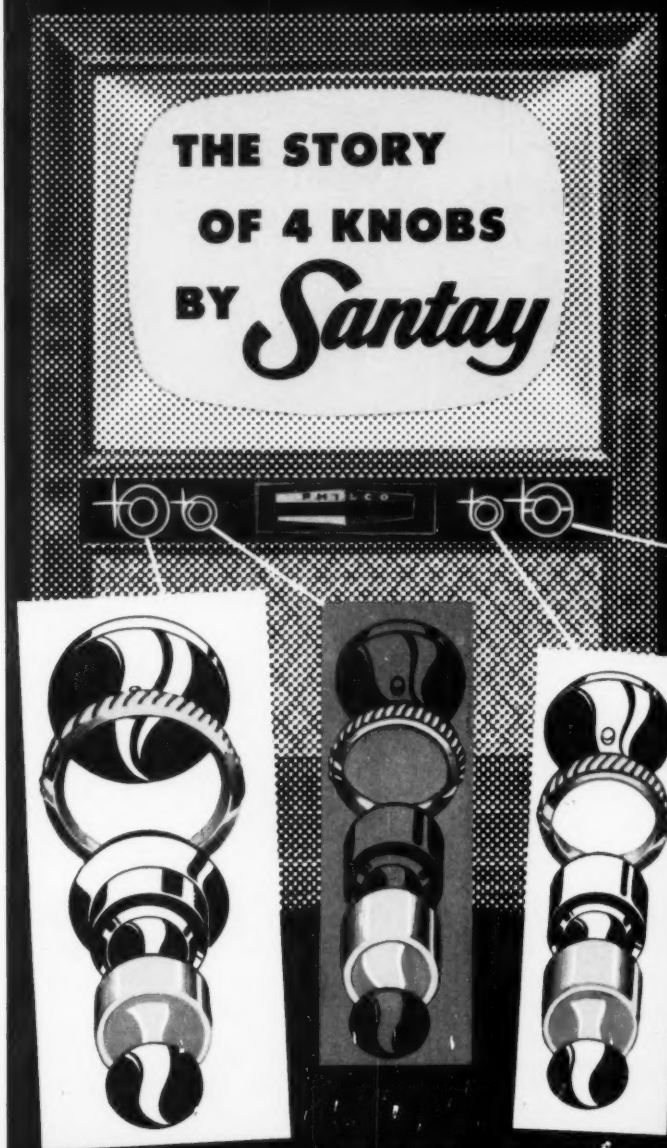
FREE - Big, beautifully illustrated 36 page brochure giving facts and figures on Industrial Maine will be sent without cost or obligation to executives. Ask for it on your company stationery.





MAINE DEVELOPMENT COMMISSION State House, Augusta II, Maine

THE STORY OF 4 KNOBS BY Santay



4 knobs – 20 parts

One example of how **Santay** molds, stamps, finishes and assembles knobs for radio and television sets manufactured by the industry's leaders. Here's an all new **Philco** . . . ultramodern in engineering . . . the latest in design. Given the new **Philco** television knobs **Santay** completely designed and engineered the metal components in relation to plastic of twenty individual parts to give a combination of richly colored plastic . . . sparkling brass and fine paint finishing completely assembled ready for installation by **Philco**. This required the vast experience of **Santay** and their diversified types of equipment and facilities. Each element a separate **Santay** operation . . . all combined under one roof.

A story Santay is proud of . . . a story of why leading manufacturers such as Philco choose and depend on Santay for major parts of their finished products.

A Santay representative will be happy to tell you the story of how plastics and metals can cut costs . . . enhance the appearance of your products. Write or call today!

SANTAY CORPORATION 355 N. CRAWFORD AVENUE, CHICAGO 24, ILLINOIS. PHONE SACRAMENTO 2-2900

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INJECTION MOLDING · METAL STAMPING · ELECTRO MECHANICAL ASSEMBLIES

DAKE PRESSES *for Compression Molding*

This 25-ton air-operated press with 4-post guided platen is typical of the Dake Hydraulic Presses which serve the plastics industry. These presses are built up to 300-ton capacity and can be engineered to meet your individual requirements.

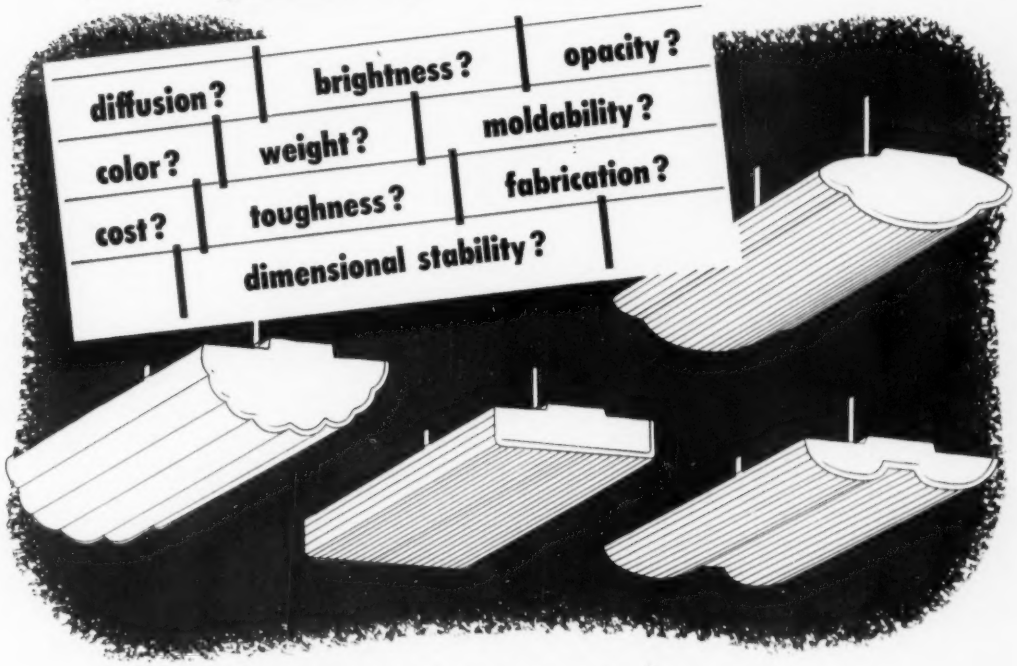
The press above is a type used for compression molding of Fiberglas laminates, and can be set to operate at any pressure within its range. These presses are available with thermostatically-controlled heated platens.

We will welcome an opportunity to discuss your compression molding problems, and quote on equipment engineered to your special needs.

Dake Engine Company, 648 Seventh St., Grand Haven, Mich.

DAKE PRESSES

What's your lighting fixture problem?



Koppers "EVENGLO" Polystyrene is your best solution!

KOPPERS "EVENGLO" POLYSTYRENE can solve your lighting fixture problem best because it gives you more optical and mechanical advantages than other materials commonly used for fluorescent fixture applications.

"Evenglo" is optically superior because you can exercise more accurate control over opacity, diffusion and color in the finished product. In effect, you can specify the color tone of light, degree of brightness and amount of diffusion desired, and you can be sure your specification will be maintained exactly in each "Evenglo" panel, from first to last.

Koppers Polystyrenes 8X and 81 are the types normally used in formulating "Evenglo." Its high heat distortion temperature gives it a decided advantage over competitive polystyrenes. "Evenglo's" unrivaled combination of easy moldability, dimensional stability, light weight, ease of fabrication and low cost makes it a desirable choice over other plastics and glass.

Koppers application engineers will be glad to demonstrate the versatility of "Evenglo" Polystyrene and to recommend the "Evenglo" formulation that fits your specific requirements.

Write for New, Free Bulletin C-2-162

It contains technical data about "Evenglo's" physical and optical properties, and outlines the scope of its usefulness in the lighting field.

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You saw this ad in Tool Engineer, Machinery, Modern Machine Shop, American Machinist, Iron Age.

CRUCIBLE MOLD STEEL TOOL STEEL

It means a lot to you that mold steel and tool steel are one-and-the-same at Crucible.

Our tool steel has an outstanding reputation, the result of years of experience and highly specialized handling.

Crucible mold steel benefits from our vast experience with other tool steels. That's why they are consistently chosen for the most exacting molds. Actually Crucible mold steel *is* better. It's *tool steel* – and it's available from stocks from 13 warehouses strategically located from coast to coast.

SPI SOCIETY OF THE PLASTICS INDUSTRY

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MOLD STEEL

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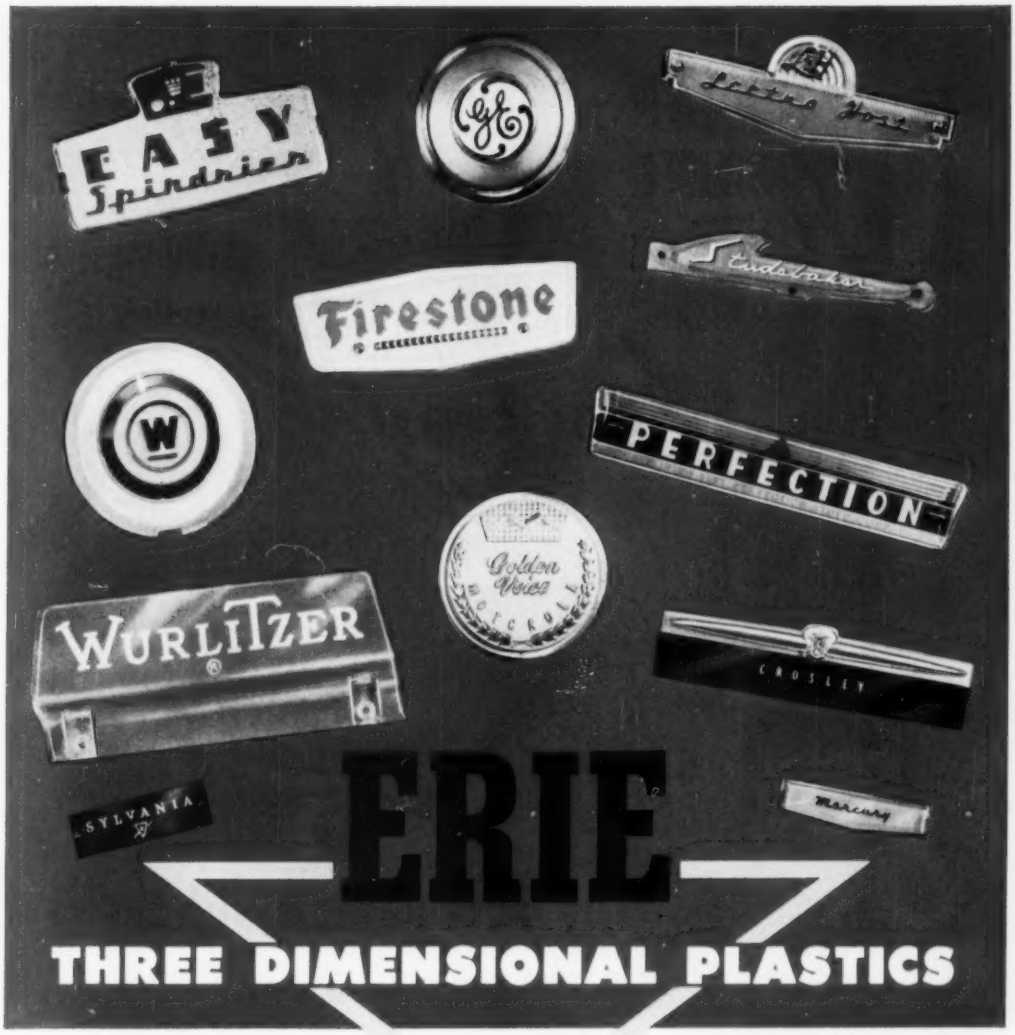

for Name Plates and Trademarks

YOUR trademark or trade name may be only a means of identification on your product. If it is custom molded of Erie Three Dimensional Custom Molded Plastics, it becomes a spot of beauty that brings your symbol to the attention of the buyer with the sparkle of a rich jewel, and enhances the sales appeal and sales value of your product. Often your trademark can be embodied in a functional part, as a handle or knob. For execution of your ideas, or for help in formulating them, come to Erie . . . the pioneer in custom injection molded plastics.

Write for your copy of bulletin,
"Who We Are . . . What We Do in Plastics."

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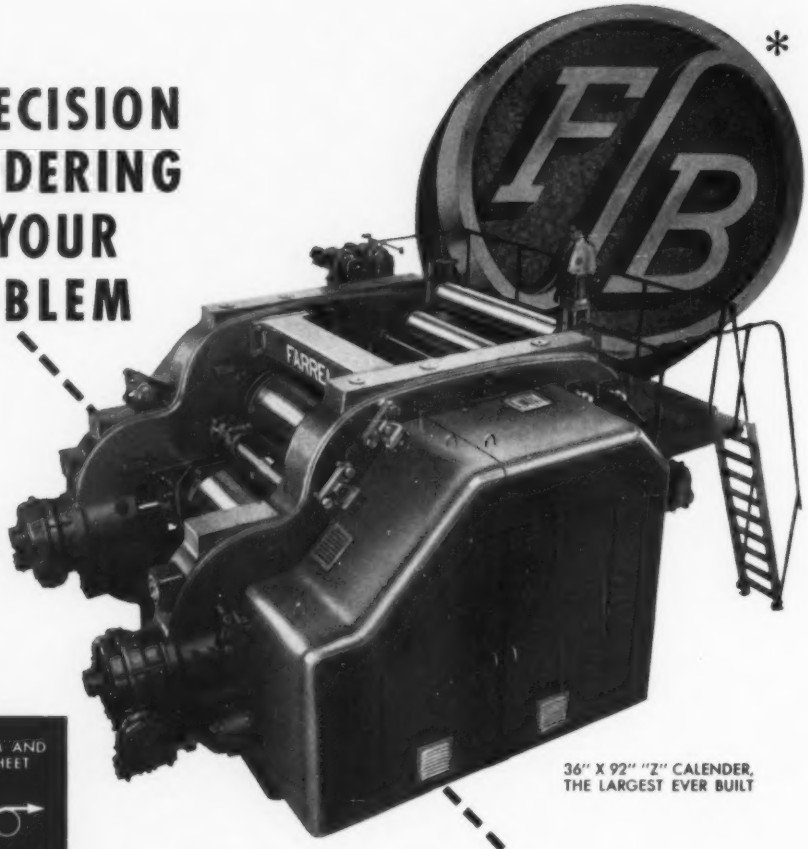
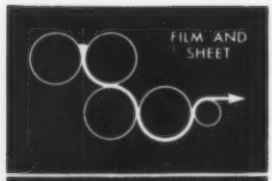
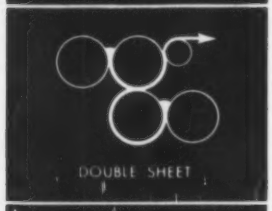
Factories: **ERIE, PA. • LONDON, ENGLAND • TORONTO, CANADA**

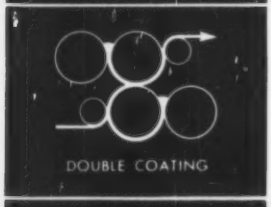
IF PRECISION CALENDERING IS YOUR PROBLEM

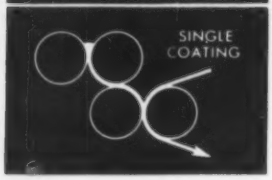


36" X 92" "Z" CALENDER, THE LARGEST EVER BUILT









The Farrel-Birmingham Z* CALENDER is your answer

The "Z" calender has established new standards for accuracy in calendering both rubber and plastics. It has proved to be equally outstanding for the high-speed production of film and sheet, and for single and double coating.

This precision machine was originated and developed by Farrel-Birmingham, the largest producer in the world of rubber and plastics processing machinery.

If precision calendering is your problem, send for further information about the "Z" calender. Ask for a copy of Bulletin 196.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT
Plants: Ansonia and Derby, Conn., Buffalo, N.Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

FB-808A

F-B PRODUCTION UNITS—Banbury Mixers • Plasticators • Pelletizers • Mixing, Grinding, Warming and Sheeting Mills • Bale Cutters • Tubing Machines • Refiners • Crackers • Washers • Calenders • Hose Machines • Hydraulic Presses • and other Equipment for Processing Rubber and Plastic Materials.

Farrel-Birmingham *®

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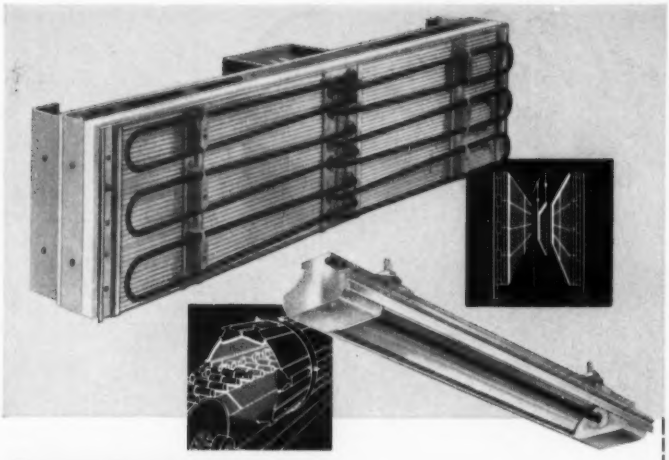
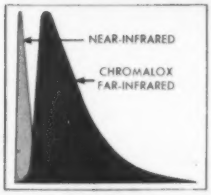


CHROMALOX
Far-infrared
solves hundreds of heating problems

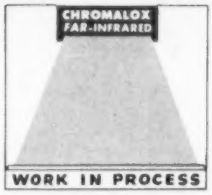
Here's your quick, economical and easy solution for curing, drying, degreasing, dehydrating, baking and other heating jobs. Pre-engineered Chromalox Units make oven building as simple as A-B-C, generate uniformly absorbed far-infrared heat for a multiplicity of processing needs. Temperatures up to 700° F are easily selected, accurately maintained. Low initial cost, low write-off cost, low operating cost!

ONLY CHROMALOX GIVES YOU ALL THESE ADVANTAGES



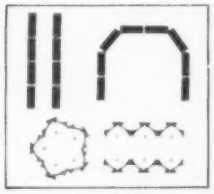
Color Blind Radiation

Longer far-infrared wave lengths are absorbed efficiently by all colors and textures.



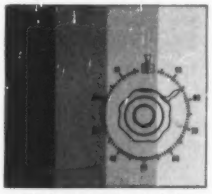
Heat Without Hot or Cold Spots

Chromalox radiant energy goes to work in a uniform pattern to span widest conveyor.



Low-Cost Oven Assembly

Pre-engineered Chromalox units require minimum expense to erect into complete ovens.



Infinitely Variable Heat Output

Heat from 0 to 100% of capacity to fit the exact temperature needs of the work.

plus

- **SHATTERPROOF CONSTRUCTION**—nothing to break or contaminate the work in process.
- **NON-DIMINISHING OUTPUT**—with all-metal Chromalox tubular far-infrared generators.
- **HIGH INTENSITY RADIATION**—with top BTUs per square foot.
- **QUICK HEAT-UP**—with energy transformed instantly into heat on the work.
- **ADDITIONALLY SAFE**-for any work involving volatiles.
- **MINIMUM MAINTENANCE**—Because of metal-sheathed, shock-resistant, long-lasting Chromalox tubular generators.

CHROMALOX *Electric Heat*
FOR MODERN INDUSTRY

DATA SHEETS
available to you on
APPLICATIONS OF CHROMALOX RADIANT HEAT

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- ☐ R-111: Drying Silicon Carbide Discs
- ☐ R-122: Drying Abrasive Cloth

ASPHALT
- ☐ L-1055: Melting Korite Sealing Compound
- ☐ R-105: Heating Asphalt to Improve Sealing of Batteries
- ☐ RP-203: Drying Asphalt Tile

AUTOMOTIVE
- ☐ R-126: Drying Tractor Parts
- ☐ R-118: Baking Synthetic Enamel on Gasoline Engines Also see: Paint Baking

BATTERY
- ☐ R-105: Heating Asphalt to Improve Sealing of Batteries

BOTTLING (see Glass)

CERAMICS
- ☐ R-113: Drying a Water-Base Glaze on Ceramic Tile
- ☐ R-134: Preheating Dinnerware to Prevent Warping
- ☐ R-137: Drying Pottery

CHEMICALS (see Plastics)

COMFORT HEATING
- ☐ L-1077: Keep Men Warm, Keep Work on Schedule
- ☐ R-114: Comfort Heating for a Foundry Worker

DEGREASING
- ☐ R-116: Vaporizing Oil from Sheet Metal Parts Also see: Paint Baking

DRUGS (see Glass)

ELECTRONICS
- ☐ R-109: Drying Cement Base in Television Tubes

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FOUNDRY
- ☐ L-1060: Skin Drying of Molds
- ☐ L-1083: Core Drying
- ☐ L-1096: Shell Molding Goes Automatic
- ☐ R-115: Comfort Heating for The Foundry Worker
- ☐ R-130: Drying Precision Plaster Molds
- ☐ R-135: Shell Molding

GLASS
- ☐ C & R-2: Sterlizing & Preheating Bottles
- ☐ R-127: Heating Television Tubes to Bake Interior Graphite Coating

PAINT BAKING
- ☐ L-1064: Drying Lacquered Metal Parts
- ☐ L-1065: Improves Enamel Baking Five Ways
- ☐ L-1066: Bakes Big Parts or Small, Fast or Slow
- ☐ L-1080: Baking Paint on Radiators
- ☐ R-118: Baking Synthetic Enamel on Gasoline Engines
- ☐ R-119: Baking Paint on Metal Awnings
- ☐ R-131: Baking Paint on Meter Parts
- ☐ R-138: Drying Ink and Paint on Toothpaste Tubes

PAPER
- ☐ R-134: Drying Glued Paper Sheeting

PLASTICS
- ☐ L-1086: Drying Vinyl Coating on Imitation Leather
- ☐ L-1091: Post-Forming Formica
- ☐ R-101: Molding Kapok Center for Softballs
- ☐ R-102: Drying Plastic Powders
- ☐ R-104: Preheating Micarta Strips for Punching
- ☐ R-121: Dehydrating Vinyl Sheets
- ☐ R-123: Drying Plastic Laminates
- ☐ R-128: Curing Plastic Coating on Spring Clips
- ☐ R-129: Fusing Vinyl to Chip Board
- ☐ R-132: Embossing Vinyl
- ☐ RP-210: Heating Plexiglas for Vacuum Forming
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- ☐ L-1090: Silk Screen Process Drying
- ☐ R-103: Static Removal
- ☐ R-107: Drying Ink on a Miehle Vertical Press
- ☐ R-108: Ink Drying on 8-Unit Web-Fed Offset Press
- ☐ R-110: Eliminating "Offset" on Duplicating Machines
- ☐ R-124: Drying Ink on a Goss Press
- ☐ R-136: Silk Screen Process Drying

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- ☐ L-1055: Dehydrating Refrigerator Coils

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- ☐ Far-Infrared Food Warmer

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- ☐ L-1056: Curing Latex Foam Sponge Rubber
- ☐ R-125: Cementing Crepe Rubber to Wooden Soles

TEXTILES
- ☐ L-1068: Fusing Vinyl to Cloth Work Gloves
- ☐ R-112: Dehydrating Braiding Material

EDWIN L. WIEGAND CO., Radiant Heating Div.
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☐ Send me application reports I have checked.

☐ Have a Chromalox Application Engineer get in touch with me.

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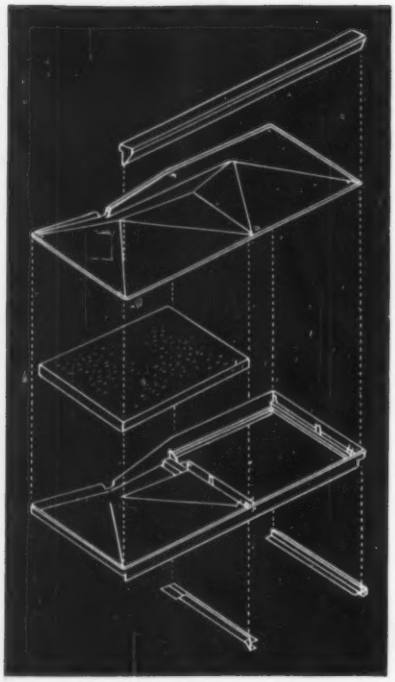
PARTNERS IN PERFECTION!

Bridgeport helps team plastic with metal to make a superior refrigerator by—



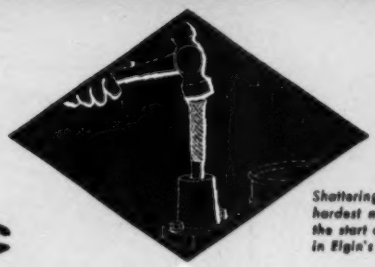
Westinghouse

To give customers the advantages of plastic *plus* the benefits of metal, Westinghouse designed both materials into the baffle of its new line of "Frost-Free" refrigerators. The finished assembly is shown above and a breakdown is diagrammed at the left. This section is responsible for the amazing automatic defrosting action of Westinghouse "Frost-Free" refrigerators. Another example of the leadership of Westinghouse.

To give Westinghouse the best performance, the *complete* knowledge and facilities of Bridgeport produced the perfect union of plastic and metal. If you, too, want to get the *most* from plastic and metal, write . . .

BPM **Bridgeport Moulded Products, Inc.**
Bridgeport 5, Connecticut

How a better abrasive begins



Shattering pure diamond bort, hardest material known, at the start of the crushing process in Elgin's laboratories.

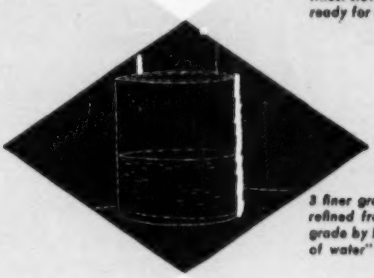
Here is how all Elgin Diamond begins . . . in an $8,000 handful of pure diamond bort. For more than 10 years, every step of production, from bort to finished DYMO compound has been completely performed in the Elgin Diamond laboratories, under the control of Elgin technicians . . . a unique production arrangement permitting maintenance of absolutely rigid quality standards.

Results in hundreds of industrial applications have proved that DYMO finishing is the sure way to reduce costs and produce a better finish every time . . . in less time! Write for specific application data today.

Every day, more and more leading producers find that it's best to FINISH WITH DIAMOND . . . ELGIN DIAMOND.

Ask for a free demonstration!

Diamond powder is mechanically sieved into ten grades. The finest sieve grade shown here is ready for further processing.



3 finer grades are further refined from the finest sieve grade by Elgin's "layers of water" process.

ABRASIVES DIVISION

ELGIN NATIONAL WATCH COMPANY

ELGIN, ILLINOIS

Final inspection assures particle uniformity and grading accuracy—for finer, faster finishes at less cost!

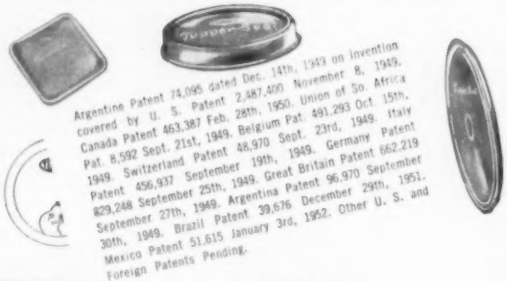
Tupper Seal, air and liquid tight flexible covers fit, and are included in the sets of all Tupperware Canisters.

The Tupperware 50 oz. Canister is "standard equipped" with the Tupper Seal, air and liquid-tight flexible Pour All cover.

The Tupper Seal, air and liquid-tight flexible Pour All cover is used on every Tupperware 20 oz. Canister.

The Tupper Seal, air and liquid-tight, Pour All cover as a cover for 46 oz. cans; Tupperware Sauce Dishes and other containers of metal, glass or pottery. Foods easily dispensed without removing entire cover.

The Tupperware Wonder Bowls are usually fitted with Tupper Seal, air and liquid-tight covers.

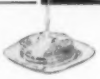


Argentine Patent 74,095 dated Dec. 14th, 1949 on invention covered by U. S. Patent 2,487,400 November 8, 1949. Canada Patent 463,387 Feb. 28th, 1950. Union of So. Africa Pat. 8,592 Sept. 21st, 1949. Belgium Pat. 491,293 Oct. 15th, 1949. Switzerland Patent 48,970 Sept. 23rd, 1949. Italy Patent 456,937 September 19th, 1949. Great Britain Patent 662,219 829,248 September 25th, 1949. Argentina Patent 96,970 September 27th, 1949. Brazil Patent 39,676 December 29th, 1951. 30th, 1949. Mexico Patent 51,615 January 3rd, 1952. Other U. S. and Foreign Patents Pending.

TUPPER / Seals

air and liquid-tight, flexible covers for Tupperware Tumblers, Canisters, Wonder Bowls, Cereal Bowls and many another container of glass, metal and pottery, the contents of which it is desired to keep fresh and wholesome.

TUPPER /



FORMAL NOTICE! 9th November, 1949

EXCLUSIVE!

U. S. Patent #2,487,400

The Tupper Corporation has attained a position of leadership in this industry by incurring great expense and expending painstaking effort in the development, design, manufacture and exploitation of its many world-known products.

The Tupper Corporation further has anticipated the inevitable attacks to which leadership is subject and has taken measures provided by law to preserve the creative rights to its products, methods and design by patent protection both in the United States and abroad.

Tupper Seals for Tupperware shown in this advertisement are just a few of the forms covered in this manner and are specifically covered by U.S. Patent #2,487,400.

Only the Tupper Corporation, by U.S.Patent #2,487,400 has the right to make, use and vend container closures in connection with any and all types of containers throughout the United States and its territories as covered by the claims of the Patent.

Tupper Corporation will protect, according to law, the exclusive rights above granted

TUPPER CORPORATION

There's a Tupper Seal, air and liquid-tight flexible cover for Tupperware 2, 5, 8 and 12½ oz. Tumblers too, and these Tupper Seal, covers fit many other containers of metal, glass and crockery.

The Tupper Seal, air and liquid-tight flexible Pour Top cover, specially designed as a dispensing cover for specified diameters of containers holding foods such as syrups, salad dressings, catsup.

The cover of the Tupperware Bread Server which serves as a bread tray also is designed to give similar results as Tupper Seal, air and liquid-tight Flexible covers. Keeps contents fresh as no other such container.

When equipped with Tupper Seal, air and liquid-tight, flexible covers, Tupperware Cereal Bowls serve many another purpose.

The Tupper Seal, air and liquid-tight flexible cover made for Tupperware 8 oz. Tumblers also fits and is sold with all Tupperware Funnels as a base when funnels are used as storage containers.

TUPPER CORPORATION

Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

Factories, Laboratories and Sales Offices: Farnumsville, Mass., Orlando, Fla., L'Epiphanie, P.Q. Showrooms: 225 Fifth Ave., N. Y. C.

ADDRESS ALL COMMUNICATIONS TO: Department M-7

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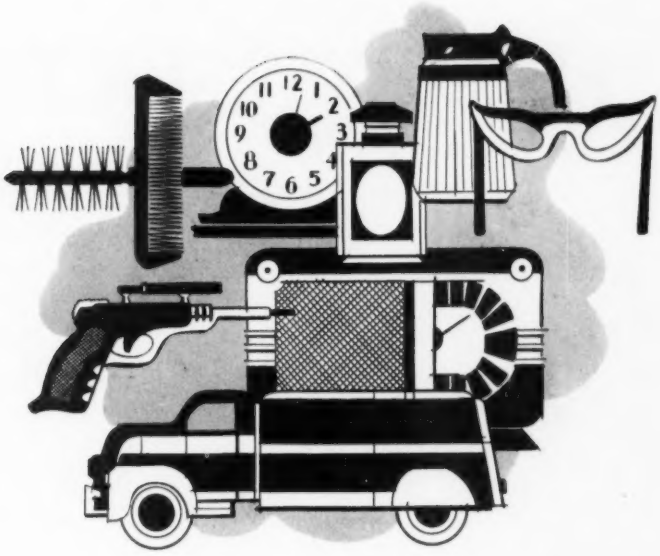
If you make products like these



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If you use reprocessed plastics . . . sell your plastic scrap . . . or have it reprocessed—it will pay you to do business with Muehlstein.

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Samples and technical information are available on request.

All types of virgin and scrap thermoplastics bought and sold.

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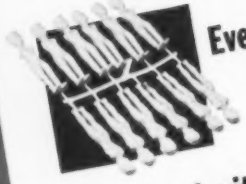
Branch Offices: Akron • Chicago • Boston • Los Angeles • Memphis

"FELLOWS" FOR SPEED...AT

PROOF



Every 18 seconds!

This 125 gram large area, thin wall shot in polystyrene in 12 cavity mold.

Time saved with 2 molds!

Lower cost per piece on single cavity molds with two machines as against double cavity mold on 16 oz. machine of another manufacturer.

8 ounce Model 5C-8

- More rapid cycling — up to 7 cycles per minute dry run.
- More ounces per shot — up to 9 oz. polystyrene, 10 oz. acetate.
- More pounds per hour — up to 100 lbs. on polystyrene.
- 'Beefed-up' press for solid clamping, simple, fast mold height adjustment.
- Open accessibility for fast maintenance.
- Grouping of controls, fully automatic operation.

Fellows injection

ITS *Speediest!*

PROOF

In 21 seconds!

This lucite toothbrush handle in an 8 cavity mold, 97 gram shot, maximum section — .225 thick. Same mold in butyrate — 18 sec.

Butyrate shot in 23 seconds!

A 139 gram shot in a 12 cavity mold.

3 ounce

Model 1B-3-15

- 6, 8 and even 10 shots per minute.
- Full automatic operation — one operator can tend 3 machines.
- 45 pounds per hour plasticizing capacity.
- 20,000 psi injection pressure for pin-point gating.
- 100% operating ease — grouped controls, simple set-up, fast warm-up.

Let us help you!

molding equipment

THE FELLOWS GEAR SHAPER CO., Plastics Machine Div., Head Office & Export Department, Springfield, Vermont.
Branch Offices: 323 Fisher Bldg., Detroit 2 • 5835 West North Avenue, Chicago 39 • 2206 Empire State Bldg., New York 1

Chemicals you live by

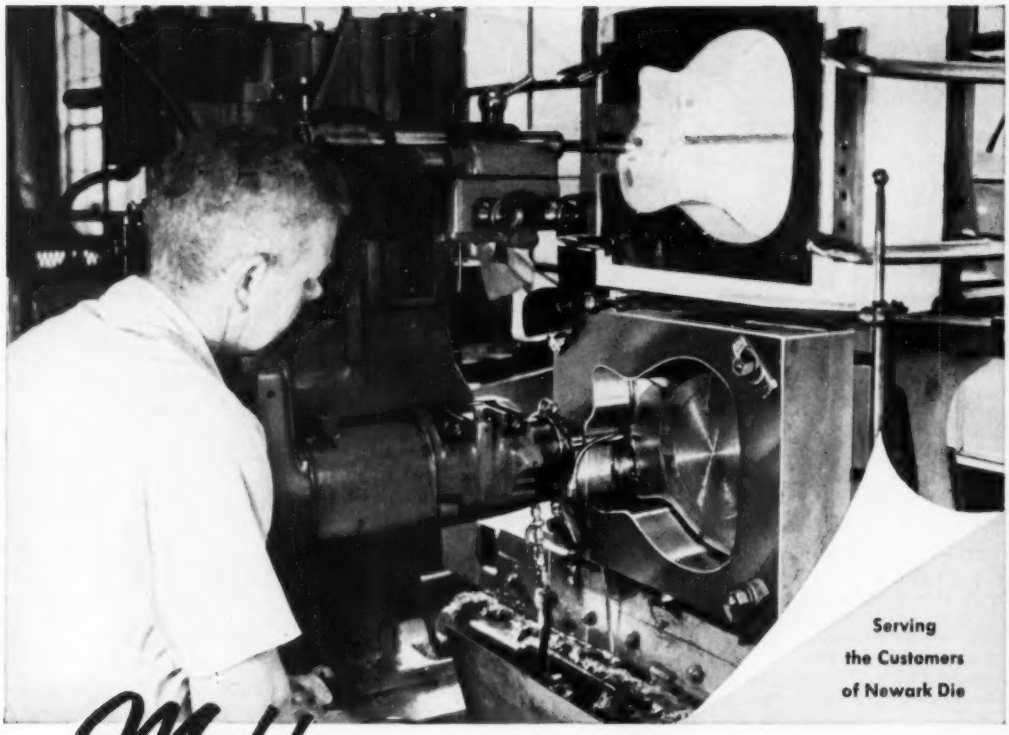
DIAMOND ALKALI'S SPECIAL CHEMICALS FOR PLASTICS COMPOUNDING

CHLOROWAX® 40	**Liquid chlorinated paraffin containing 40% chlorine by weight. Inert, nontoxic, soluble in wide variety of organic solvents.**	Highly suitable as a co-plasticizer in vinyl compounds. Lowers compounding costs at no sacrifice in quality.
CHLOROWAX® 70	**Resinous chlorinated paraffin containing 70% chlorine by weight. Cream-colored nontoxic resin. Soluble in most organic solvents. Highly resistant to burning.**	Useful as processing aid when compounded with rigid plastics, since it lowers softening point.
SURFEX® MM	**Precipitated calcium carbonate. Particle size 1 to 5 microns. Resin-coated. Low oil absorption (20 - 22 cc/100 grams).**	Useful as extender in vinyl compounds, lowering compounding costs. Contributes excellent color and light stability to organosols and plastisols.
MULTIFEX® MM	**Ultra-fine precipitated calcium carbonate. Particle size .05 to .06 microns. Uncoated.**	Used in vinyl compounds for extrusion and floor tile. Contributes improved abrasion resistance and higher gloss. Reduces compounding cost with no appreciable degradation.
KALITE®	**Precipitated calcium carbonate. Particle size about 1 micron. Oil absorption 28-32 cc. per 100 grams. Coated with 1% fatty acid.**	Used extensively in calendered 20-gauge film such as vinyl upholstery compounds. Has low oil absorption. Excellent calendering properties.

DIAMOND CHEMICALS FOR PLASTICS COMPOUNDING

DIAMOND ALKALI COMPANY • CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS®



Serving
the Customers
of Newark Die

Molds ACCURATELY DUPLICATED FROM MASTER PATTERNS ON DIE SINKING MACHINES

In Keller machines like the one shown—one of a battery in use at Newark Die—a tracer passing over a master pattern automatically controls the movements of the feeding mechanism, which in turn governs the cutting of the mold.

Because of the delicacy of this electrical control when used by the skilled craftsmen at Newark Die, the finest of work can be done on the largest of molds.

Keller die sinking machines are typical of the many types of up-to-the-minute equipment now turning out molds to serve the customers of Newark Die.

NEWARK DIE COMPANY
23 SCOTT STREET, NEWARK 3, N. J.
Phone MArket 2-3705
NODCO TRADE MARK

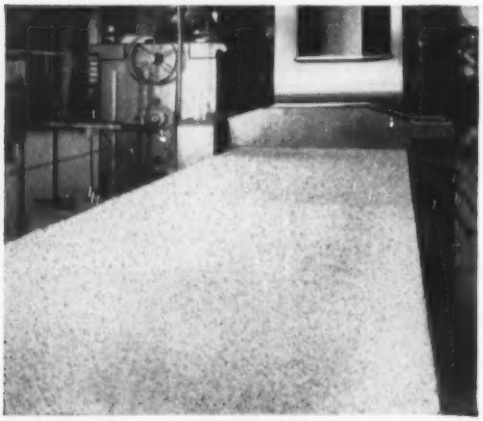
A revolutionary development in the Wood Industries

The Bartrev Press, first automatic machine to produce board in continuous strip. By using shavings, slabs, edgings and other unused wood to manufacture board, the Bartrev Press will meet the demand for fine quality board at the low cost made possible only by continuous strip production.

THE perfection of the *Bartrev Press* after 14 years development means that a new industry has been born; for the *Bartrev Press* turns unutilized wood that has hitherto been little more than an encumbrance to the forest products industries into a vast store of treasure. Here is the crucial point: *it makes possible for the first time the continuous production of board at low cost and of uniform quality.* Bartrev board comes off the Press at high speeds in a four-foot-wide continuous strip that can be cut to measure during production.

New Ways With Wood. Success today is judged not by the trees felled but by efficiency of their use. Until now, despite every effort, more than 60% of every tree felled has to be discarded or used uneconomically. The *Bartrev Press* makes such good use of this unutilized material that the cost of board will drop.

Over 8 Miles of Board a Day. A single *Bartrev Press* can produce a continuous strip of board 4 feet wide at speeds up to 30 feet a minute – enough to make a 4-foot-wide boardwalk over 8 miles long every 24 hours . . . *over 16,000 tons of board a year!* The *Bartrev Press* means as much to forest products industries as did the continuous assembly line to automobiles and the continuous strip mill to modern steel.



The *Bartrev Press* turns wood and wood waste into a continuous sheet of fine quality board at high speeds. This is automatically cut to required lengths during manufacture.

Some Characteristics of Bartrev Board: *Length:* limited only by physical considerations in handling and transportation • *Width:* up to 4 feet • *Thickness:* from 3/16" to 3/4" • *Flexural Strength:* 2,500 to 5,000 p.s.i. according to raw material and type of board required • *Dimensional Stability:* Bartrev Board reacts to humidity changes uniformly in all directions • worked with ordinary woodworking tools – and no knot holes • natural surfaces can be waxed, varnished or painted • finishes such as: veneers, laminates, metals applied by standard methods.

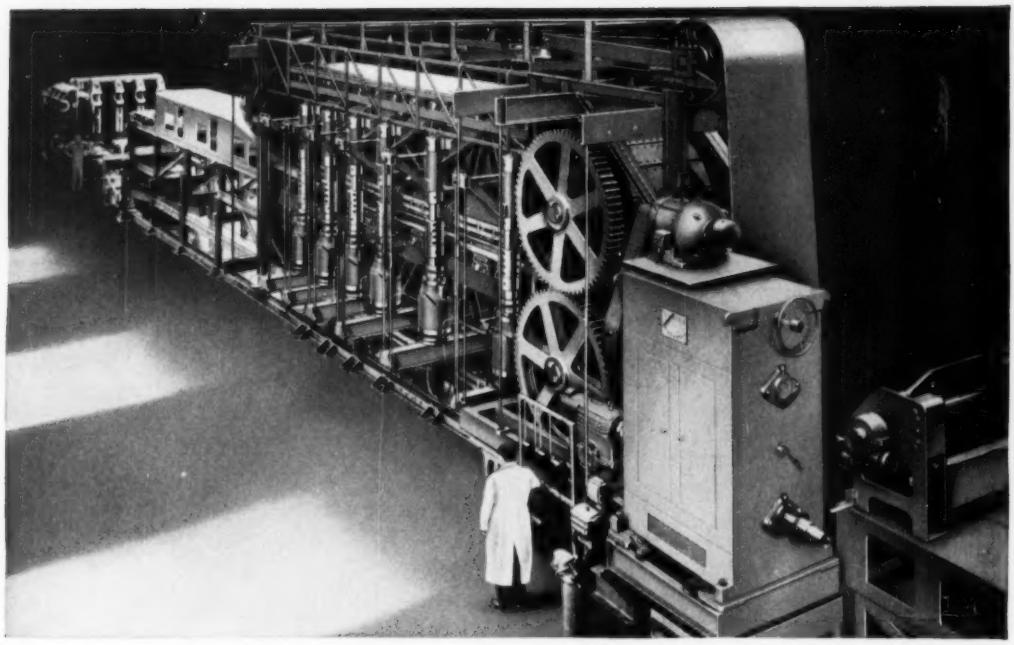
The *Bartrev Press* Opens Up Remarkable Prospects. The *Bartrev Press* is invaluable to all those engaged in the use of wood in any form. It turns waste from forest, mill and workshop into dollars. The operator of a *Bartrev Press* has no raw material problem. His raw material – unused wood – is always accumulating. Every ton of such raw material used by the *Bartrev Press* means an increase in the percentage of wood being turned to profitable account.

Some Uses of Bartrev Board: Prefabricated units for houses, offices and other buildings • for linings of buildings of all kinds • provides low cost material for ceilings, floors, flush doors, movie and theatre sets, display stands, temporary structures of all kinds • furniture and built-in furniture • low cost core for plastic laminates with many uses in stores, hotels, restaurants, built-in fixtures, all working surfaces.

First *Bartrev Press* Now In Operation. A full-scale commercial Bartrev plant is in operation near London, England. It can be inspected by arrangement. *Orders for the Bartrev Press* can now be accepted and delivery arranged from December, 1953. The installation of each *Bartrev Press* will be supervised by factory trained specialists.

ARIES FIBERBOARD CORPORATION, North American Representatives for BARTREV, LTD., 400 Madison Ave., New York City 17, N. Y. Telephone: PLaza 5-7938.

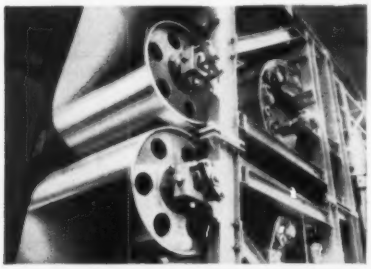
Patents: The Bartrev Process and automatic Press have been covered by Patents and Patent Applications throughout the world.



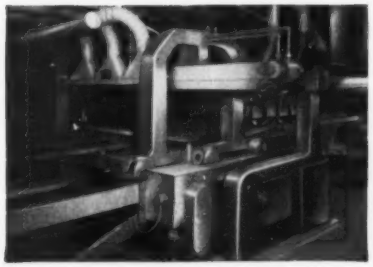
The machine that marks a new era for the Wood Using Industries

Unused wood from forest, mill and factory is mechanically reduced. After the addition of a small percentage of resin the material is fed to the *Bartrev Press* from which it emerges continuously as board that can be cut to any length. Facings of paper can be applied continuously during manufacture. The total production area required for the Bartrev plant is only 12,000 square feet.

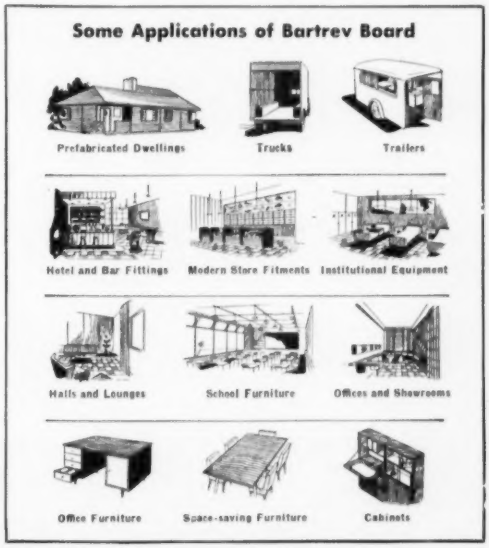
FINISHES AND FACINGS—Bartrev board makes an excellent basis for all modern finishes. **NATURAL**: Bartrev board has an attractive natural surface texture, and can be painted, waxed, varnished or lacquered. **PAPER SURFACE**: Bartrev board can be faced with paper during manufacture. It is then ready for use. When faced with plain paper it can be given the whole range of brush and spray painting. **WOOD VENEER**: Ordinary wood veneer can be applied to Bartrev board by standard methods, using either hot or cold glues. **PLASTIC FACED**: There is no finer core material than Bartrev Board for plastic laminates in demand for bars, restaurants and store fittings. Builders, architects and interior decorators will be quick to appreciate its advantages of dimensional stability and lower cost. **METAL FACED**: Bartrev board can be surfaced with metal foils. To give extra strength Bartrev board can be faced with aluminum or other sheet metals.

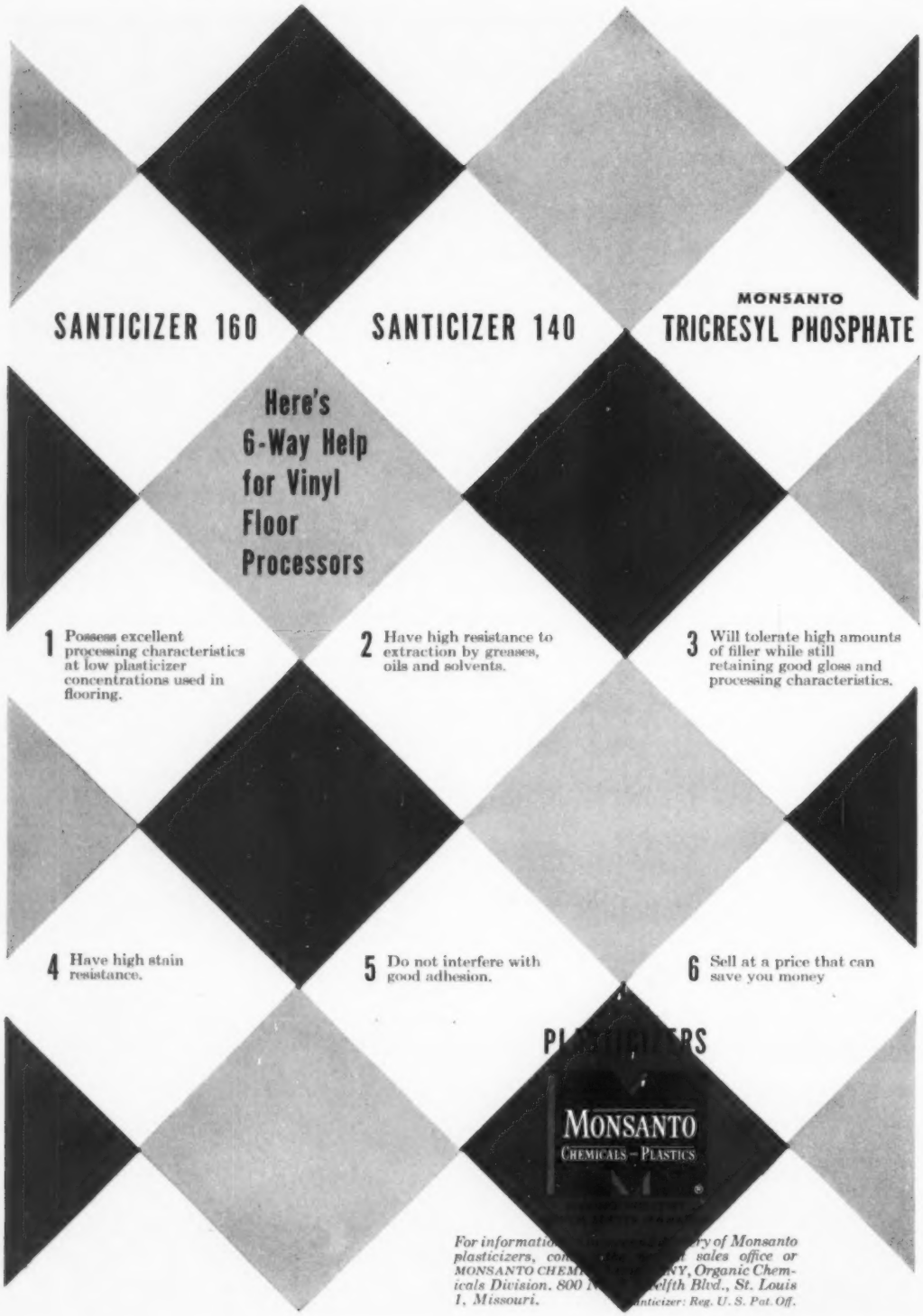


The stainless steel bands of the Bartrev Press give the board a smooth and uniform surface.



The Automatic Saw receives the emerging board. The parallel saws run continuously and trim the edges, the travelling transverse saw cuts the board to any required length.

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TRICRESYL PHOSPHATE
Here's 6-Way Help for Vinyl Floor Processors
1 Possess excellent processing characteristics at low plasticizer concentrations used in flooring.
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PLASTICS MOLDING MACHINE...

FEATURING 200-TON

Hydra-Lock CLAMP!

Outstanding new LEWIS "6" plastics injection molding machine provides the speed, economy, silent operation and compact construction of a lightweight model . . . yet handles a wide range of parts having large projected areas. Exclusive feature of this machine is the new HYDRA-LOCK high-speed 200-ton clamping mechanism . . . the safest, most powerful mold clamping device available today! Other features include injection pressures up to 15,100 psi, large platens, compensating feed, fast opening die-lock mechanism, automatic molding cycle and minimum maintenance.

Write today for this new 8-page illustrated catalog.

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Gentlemen:

Please send me Bulletin No. 102 describing the new LEWIS "6" plastics injection molding machine.

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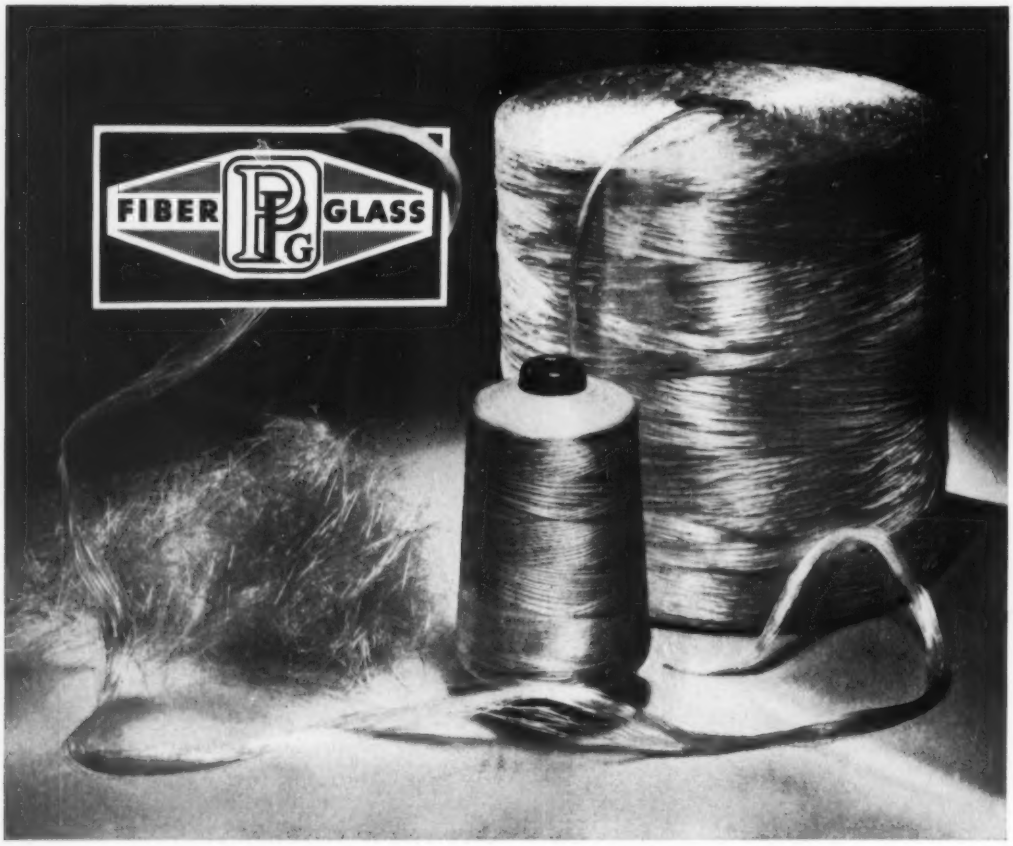
LEWIS — THE LEWIS WELDING & ENGINEERING CORPORATION



Pittsburgh Fiber Glass helps you make plastics that are BETTER SAFER LIGHTER STRONGER

With the rapidly expanding market for fiber glass reinforced plastics, "Pittsburgh" is a name to keep foremost in your plans and operations. Not just another fiber glass, but a Fiber Glass of uniformly high quality that is establishing new standards in the field.

Pittsburgh Fiber Glass is made in the nation's newest fiber glass plant, using the direct melt process and a system of controls that is producing continuous filament fiber of exceptionally uniform diameters. This is an important contribution to easier fabrication and better laminating results.

We will welcome the opportunity of giving you complete information on Pittsburgh yarns, roving and chopped strands—and the names of weavers using Pittsburgh yarns. Pittsburgh Plate Glass Company, Fiber Glass Division, 420 Fort Duquesne Boulevard, Pittsburgh 22, Pa. District Sales Offices: Chicago, Cincinnati, Cleveland, Detroit, New York, Washington.

FIBER PG GLASS PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS

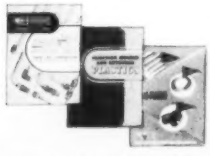
PITTSBURGH PLATE GLASS COMPANY

Molded right for writing

Our molding assignment for these Alexander pencils was to produce writing instruments properly balanced—smooth of line. Color specifications were carefully met—functional needs of the product were painstakingly watched.

This careful consideration of functional needs characterizes our production activity. First we determine whether or not plastics can do the best job for you. Then we make sure *in advance*, that the plastic material used will be *right* for your product. Our engineers and molders now go to work and create a plastic product that is *right* every way you look at it. *Right* for appearance—*right* for stability—*right* for sales appeal.

We'd like to convince you in person that ours is the *right* molding service for you. Tell us about your plastic problems. You'll receive a speedy and, we believe, a helpful and profitable answer.



Write on your letterhead for the new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about Cellulose Acetate* pipe, tubing and fittings, write for circulars containing data and illustrations.

*Trade Mark Reg.

ELMER E. MILLS CORPORATION

INJECTION MOLDED and Extruded Thermo-Plastic Materials including Cellulose Acetate, Cellulose Acetate Butyrate, Acrylates, Monochlorides, Styrenes, Vinyls, Vinylidene Chloride, Polyethylene

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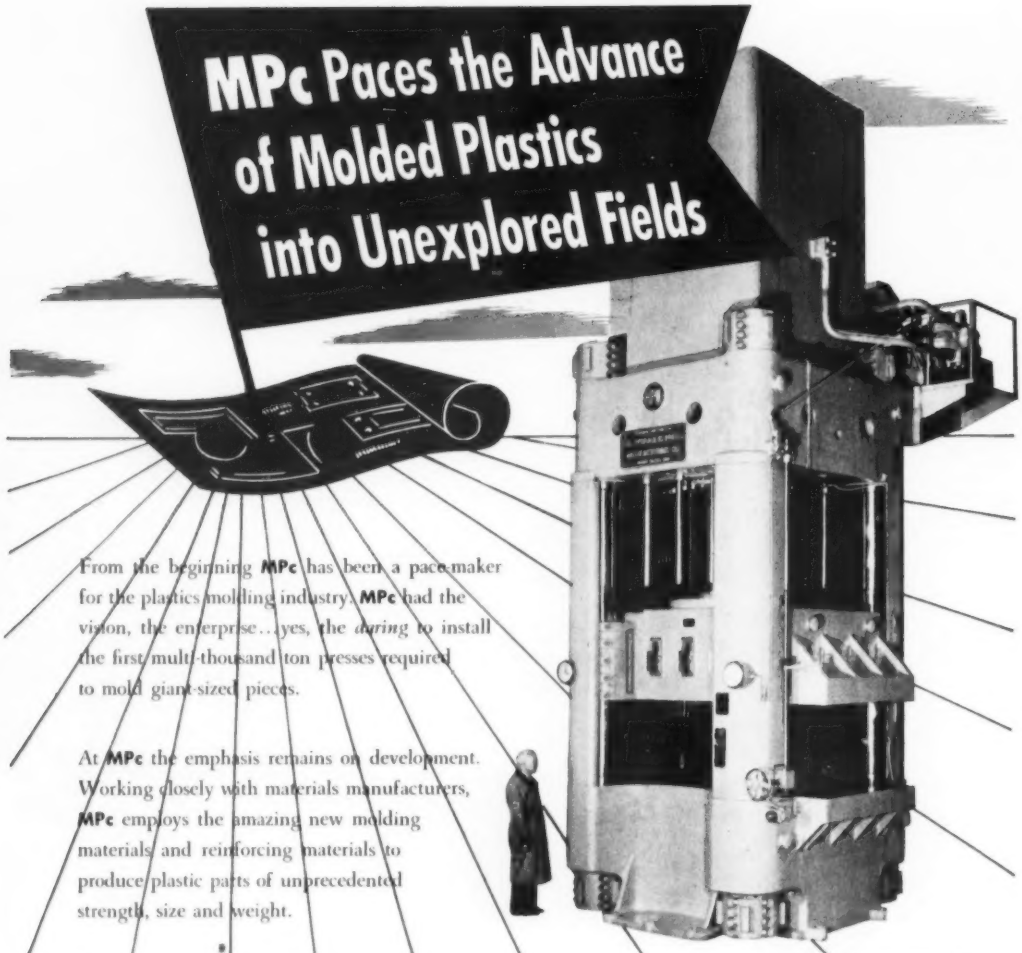
MPc Paces the Advance of Molded Plastics into Unexplored Fields



From the beginning **MPc** has been a pace-maker for the plastics molding industry. **MPc** had the vision, the enterprise...yes, the *daring* to install the first multi-thousand ton presses required to mold giant-sized pieces.

At **MPc** the emphasis remains on development. Working closely with materials manufacturers, **MPc** employs the amazing new molding materials and reinforcing materials to produce plastic parts of unprecedented strength, size and weight.

The challenge of the new or unusual is met at **MPc** with inventive engineering skill...supported by unmatched molding and tool-room facilities. Product design engineers with big ideas are invited to consult with MOLDED PRODUCTS CORPORATION, 4535 W. Harrison St., Chicago 24, Illinois.

Molding presses with capacity from 50 to 3000 tons

The MPc tool-room has produced the largest molds made in this country...

...and some of the smallest and most intricate molds

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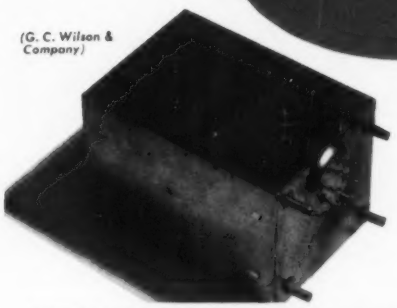
DIVISION OF ADMIRAL DISTRIBUTORS, INC.
...Pace-Makers in Plastics Molding
MEMBER: COMMITTEE ON LARGE PLASTIC MOLDINGS OF THE SPI

FREE "Data Book of MPc Facilities," an engineering-eye view of MPc press capacities and other production facilities...together with a survey of MPc special skills available for your use. Write for your copy.

IDEAS *in the making*

Araldite® Bonding, Casting and Coating Resins developed by Ciba Research are simplifying manufacturing methods, improving product efficiency, and opening new fields of product development. You will want to know more about them.

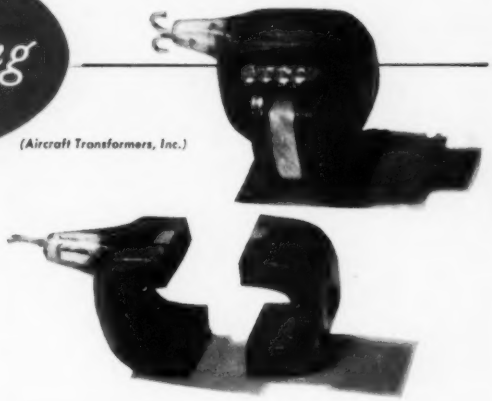
(G. C. Wilson & Company)



ELECTRONIC ASSEMBLY OF AIR-TO-GROUND ROCKET MADE MOISTURE-PROOF AND STRENGTHENED WITH EPOXY COATING RESIN

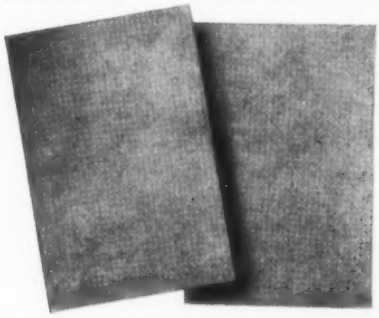
The time-saving simplicity of coating operations combined with the rugged protection afforded by ARALDITE coating resins make applications such as this routine on either a specialized assembly or mass production basis.

(Aircraft Transformers, Inc.)



EPOXY RESIN ENCAPSULATES TRANSFORMER COILS

The excellent dielectric properties of ARALDITE epoxy casting resins coupled with high affinity for metals have made them "the resin of choice" among leading electrical and electronic designers and manufacturers for potting and impregnating transformers, capacitators, coils, motor windings and similar apparatus requiring long-lasting efficiency in operation.



EPOXY RESIN PRE-IMPREGNATES GLASS CLOTH

The application of ARALDITE "CN" epoxy impregnating resins by fabricators of glass laminates suggests a wide field of related uses where the low shrinkage, excellent dielectric strength, exceptional resistance to chemical attack and durable adhesive properties provide unprecedented advantages for product "in use" efficiency. ARALDITE impregnating resins are produced in types suitable for either heat-curing or self-curing. ARALDITE is available as pre-impregnated cloth or as cured laminates.

(Cordo Chemical Company)

SEND THIS COUPON . . . or write us on your company letterhead . . . for complete technical data on the physical properties and recommended procedures for the successful use of Araldite Resins for your own fabricating needs.

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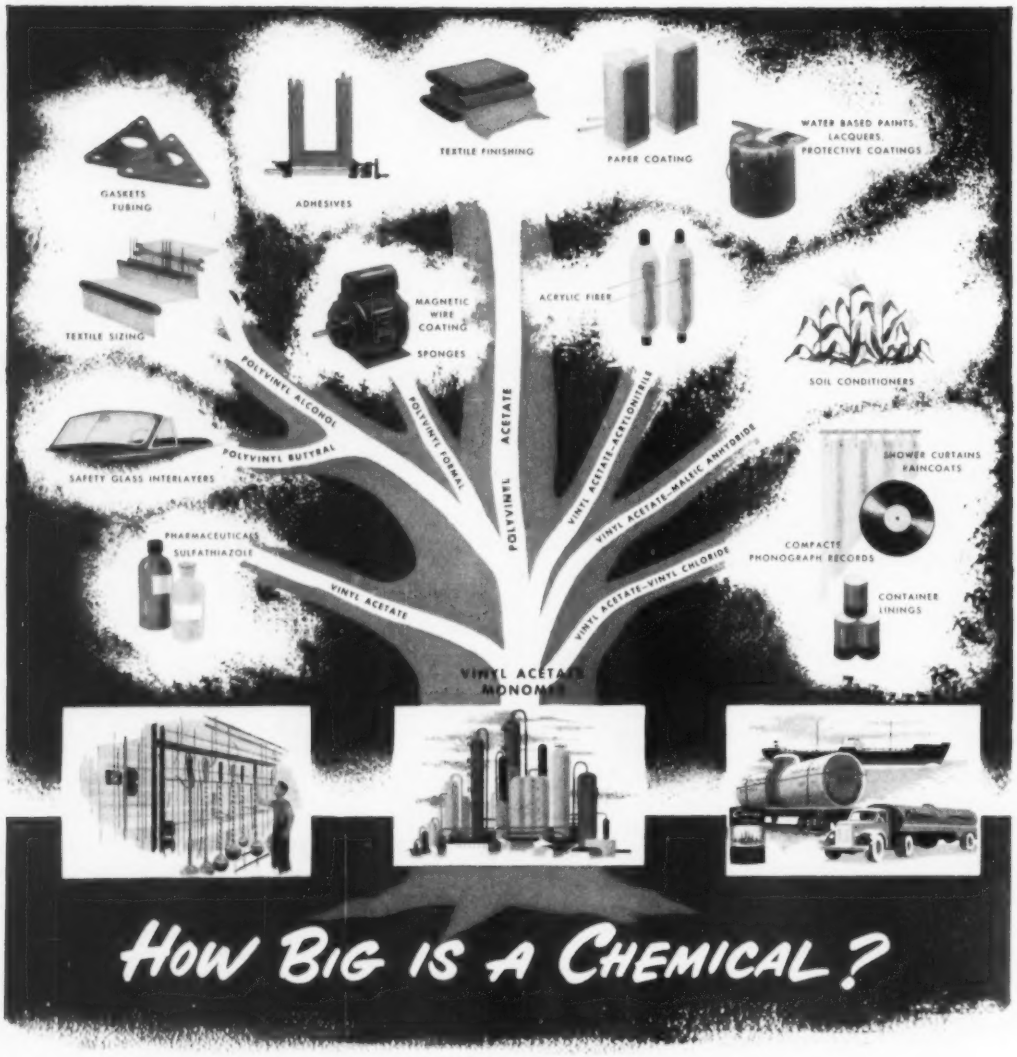


CELANESE* VINYL ACETATE MONOMER OFFERS CREATIVE OPPORTUNITIES TO HUNDREDS OF AMERICAN INDUSTRIES

How big is a chemical? As large as its production volume . . . as broad as its applications. Vinyl Acetate Monomer—the basis for countless plastic products, paints, paper, textiles, pharmaceuticals, adhesives—is big. With the start of full-scale production at the Celanese Pampa plant, Vinyl Acetate gains a bigness that opens the door to more intensive research, far-reaching product development.

Celanese Vinyl Acetate Monomer—ready in tankcar quantities within a few weeks—will be produced by specially developed processes, utilizing Celanese-produced raw materials, in the newest, most up-to-date petrochemical plant in the country. Two grades of monomer will be available: A-grade, stabilized with diphenylamine, and H-grade, inhibited with hydroquinone.

The possibilities and opportunities for vinyl acetate derivatives warrant thorough investigation. We will be glad to assist you with complete technical data and literature. Write:

Celanese Corporation of America, Chemical Division, Dept. 577-G, 180 Madison Avenue, New York 16, N. Y.

Celanese CHEMICALS

*Reg. U. S. Pat. Off.

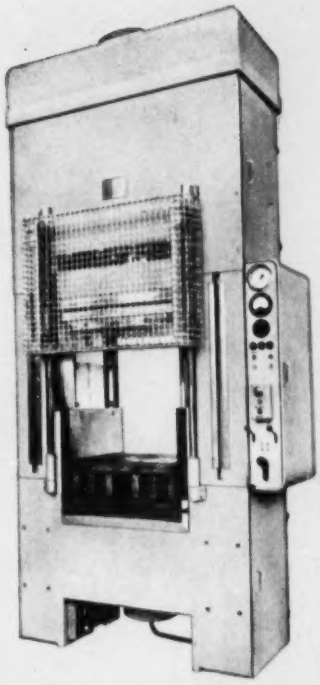
Choice of 3 pressures per press

Protected hydraulic system

Automatic cycle control

Rigid, precision construction

BIPEL AUTO-CONTROL COMPRESSION/TRANSFER PRESSES



Type 100 Bipel Molding Press fitted with transfer ram

pressure range	50 — 100 — 150 tons
Type 40	20 — 40 — 60 tons
Type 200	100 — 200 — 300 tons

Our files contain many happy reports from molders who have purchased modern, efficient Bipel presses and drives to replace press units which were subject to excessive stoppages and which produced a far higher percentage of reject moldings than they should have.

Bipel presses embody several patented features and are powered by a unique medium-pressure-plus-intensifier system which provides a range of three pressures (1:1, 2:1, 3:1) from a single source. This economical drive system can power up to twelve presses. Or a miniature unit can be built into the press frame for individual press operation. A special unloading valve *which cannot by-pass fluid under pressure but always unloads* safeguards the hydraulic system at all times.

Chances are, it will cost more to continue operating your obsolete presses than it will to replace them with high-efficiency, high-production Bipel units. We will gladly furnish the facts and figures you need.

Uniform Production Minimum Rejects

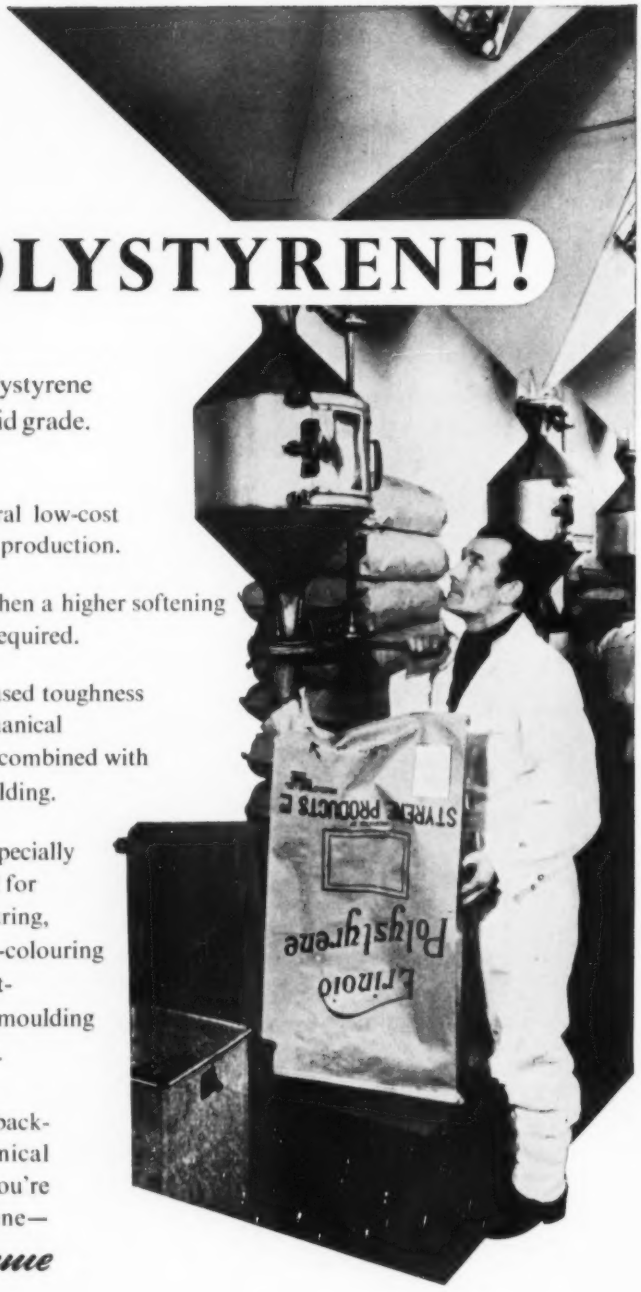
The auto-control mechanism of Bipel presses is not restricted merely to opening and closing the press. The most complex molding cycle can be repeated time after time. Provision can be made for "breathing," and for low pressure "dwell" before full pressure is applied. Production of uniform, usable moldings is practically one hundred per cent.

B·I·P GROUP

ENGINEERING LTD.

Aldridge Road, Streetly, Staffs, England

POLYSTYRENE!



For every purpose to which polystyrene can be put there is a special Erinoid grade.

Erinoid **G.P.**—for general low-cost quantity production.

Erinoid **H.S.**—for use when a higher softening point is required.

Erinoid **H.I.**—for increased toughness and mechanical stability, combined with easy moulding.

Erinoid **S.T.**—Beads—specially produced for dry-colouring, extrusion-colouring and direct-injection moulding processes.

ERINOID POLYSTYRENE is backed by a world-wide technical and marketing service. If you're thinking about polystyrene—

Erinoid's the name

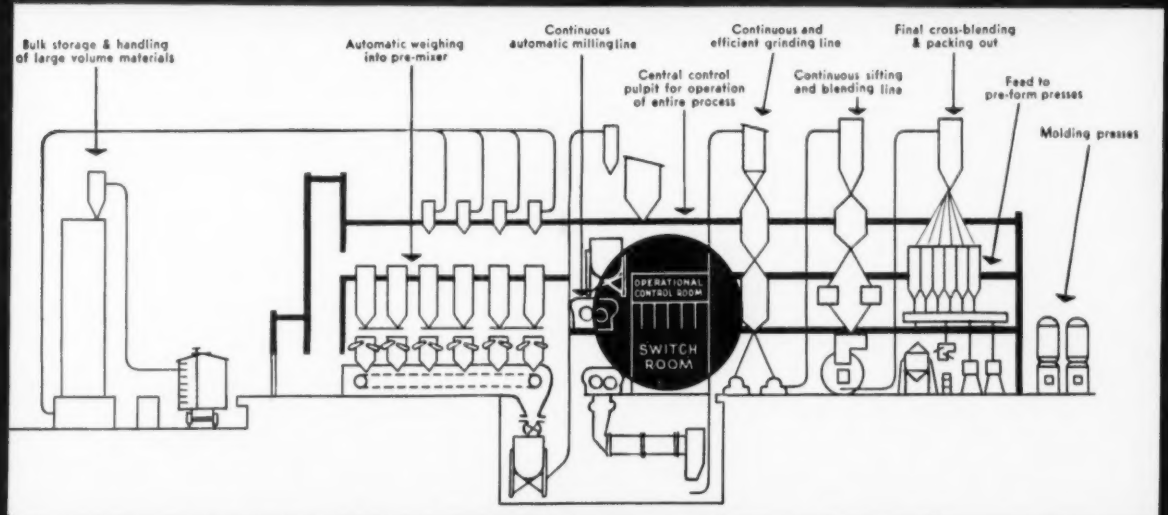
STYRENE PRODUCTS LTD

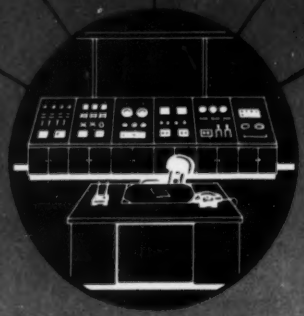
96 PICCADILLY · LONDON · W1 · TELEPHONE: GROSVENOR 7111

MARKETING AGENTS: ERINOID LTD · STROUD · GLOUCESTERSHIRE · ENGLAND · TELEPHONE: STROUD 810

"Push Button"

PHENOLIC MOLDING POWDER PLANT


Bulk storage & handling of large volume materials
Automatic weighing into pre-mixer
Continuous automatic milling line
Central control pulpit for operation of entire process
Continuous and efficient grinding line
Continuous sifting and blending line
Final cross-blending & packing out
Feed to pre-form presses
Molding presses
OPERATIONAL CONTROL ROOM
SWITCH ROOM



● From the console platform, one man controls automatically the output and quality. Here is a real, streamlined phenolic molding powder plant with many innovations and features. This Phenolic Molding Powder Plant has aroused great interest in the industry. It represents the combined experience of several of the nation's top plastics specialists . . . men who work for this organization.

It is one of the many current projects on our boards . . . for example: A Tire Manufacturing Plant; a Process for Manufacturing Plastic Pipe; a Compounding System and Mill Room for Mechanical Rubber Goods Plant.

The combination of Hale and Kullgren, Inc., and The Aetna-Standard Engineering Company offers a complete service to the rubber and plastics industry. We are equipped to deliver a complete plant, a specialized process, engineering service or individual machines for processing rubber and plastics.

Address your inquiry to Hale and Kullgren, Inc., P. O. Box 1231, Akron, Ohio. Give us an outline of your needs and we will give you prompt and authentic information.

★

COMPLETE SERVICE ON RUBBER & PLASTICS
a complete plant : a specialized process : an engineering service or individual machines

National Erie Products for the Plastic and Rubber Industries • Extruders • Simplex Doors for Autoclaves • Mills and Hydraulic Presses.

This old and well-known line of machinery was acquired March 1, 1952, by The Aetna-Standard Engineering Company. They are manufactured in their Warren, Ohio, and Ellwood City, Pa., plants. The sales and engineering of the National Erie line is the responsibility of Hale and Kullgren, Inc., Akron, O.

SALES and ENGINEERING by

HALE AND KULLGREN INCORPORATED

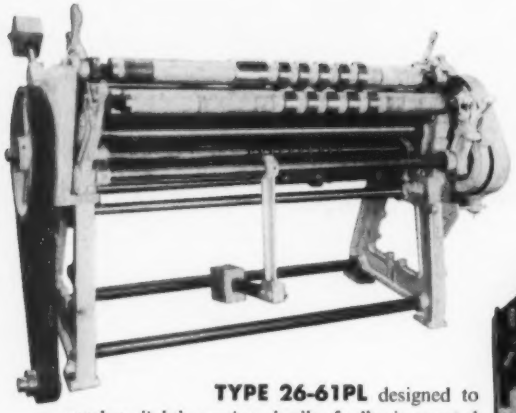
P. O. BOX 1231 AKRON, OHIO

MANUFACTURING by

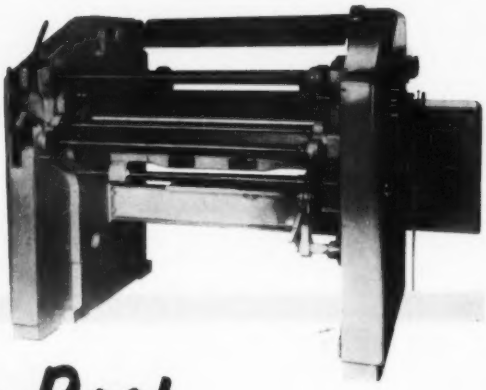
Aetna-Standard

THE AETNA-STANDARD ENGINEERING CO.
PITTSBURGH, PA

Plants in Warren, Ohio
Ellwood City, Penna.



TYPE 26-R-7 Camachine with razor blade slitting for light gauge plastic film, producing high quality rolls of varying width and diameter at speeds up to 700 fpm.

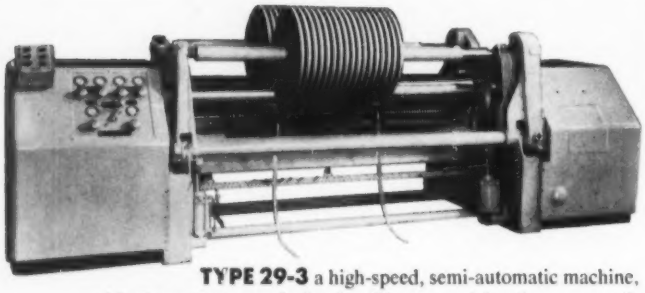


TYPE 26-61PL designed to produce *lightly tensioned* rolls of adhesive coated plastics (and similar materials) to help overcome a tendency toward excessive adhesion of plies in the finished rolls, especially after long storage.

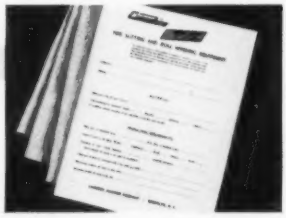
Which Slitter is Best...

FOR YOUR JOB?

There's one easy way to find out which slitter will do the best job for *you*. It will take only a few minutes of your time to use the Camachine Dataform. Then, without cost or obligation, you'll receive an engineered recommendation from Cameron specialists. Here's all you have to do . . .



TYPE 29-3 a high-speed, semi-automatic machine, with finger-tip controls for handling materials of uneven caliper, coated or tacky surfaced at speeds up to 1500 fpm. Versatile in application to many types of materials.



Let Us Know Your Problem-

Answer a few simple questions on the Camachine Dataform. Our engineers can then recommend the most efficient and economical equipment for you. Write today for your free copy of the Camachine Dataform. Do it now.

CAMERON MACHINE COMPANY
61 Poplar Street, Brooklyn 1, N.Y.

Don't wind up with less than a Camachine®

AA-281

Forgecraft designed to sell with

HERCOCEL®

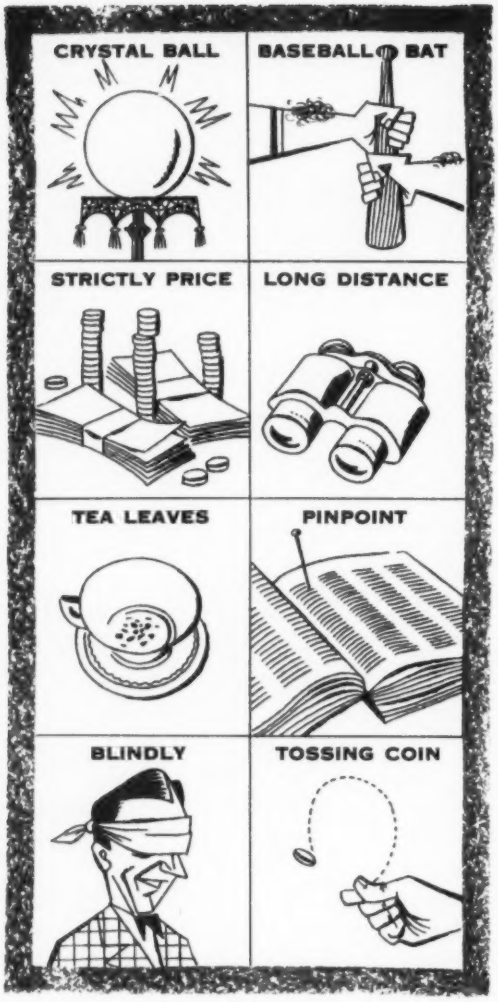
Duraset handles made from a special high-acetyl formulation of Hercocel A are a feature of Washington Forge's line of kitchen tools. Durable, colorful, attractive, these handles resist kitchen greases, fruit and vegetable acids, and alkaline soaps and detergents. Electronically sealed to the metal sections, they will not loosen. Most important, high-acetyl Hercocel permits repeated immersion in hot water, and safe cleansing in modern home dishwashers. For more information on versatile Hercocel, including a new flame-resistant type, and Hercules design and technical assistance, write:

HERCULES POWDER COMPANY

Cellulose Products Department, 916 Market Street, Wilmington 99, Del.

Handles molded for Washington Forge, Inc., Englishtown, New Jersey, by Laurel Plastics Company, Lakewood, New Jersey.

By which method do you choose your molder?



The guy who tries any of those methods is a blood brother to the fellow who, on a hunch, plays a 100 to 1 shot across the board. It would be a great day *if* he won, but his chances are slimmer than last year's profits after taxes.

The sages of the ages among plastics buyers advise a series of simple stratagems: Select a molder with a sound reputation (Boonton's got one), talk your problems out with his engineers (ours are wise old owls and most cooperative), agree to a price that won't force him to use underpaid child labor (every Boonton employee is over 18 and well paid), and establish a sensible delivery schedule.

Barring floods, A-bombs and other unforseeable catastrophes, you should find a molder selected in this manner to be as honest as A. Lincoln, as accurate as W. Tell, and as dependable as F. Time.

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

NEW YORK OFFICE — CHANIN BUILDING, 122 EAST 42ND STREET, MURRAY HILL 6-8540

PLASTIC PIPE LINE

During the recent disastrous flooding which occurred in Eastern England, use was made of a plastic pipe line for the purpose of discharging a considerable volume of water accumulated in the flooded depressions back to the sea.

This unusually interesting application of light-weight plastic pipe lines is evidenced in the system of emergency water piping which has been produced on R. H. Windsor R. C. 100 Twin-Screw Extrusion Machines by Messrs. J. J. Wade (London) Limited at the request of the Ministry of Works.

The pipe lines are of extruded thermo-plastic Polythene which was chosen for its lightness (specific gravity 0.92), its flexibility and slight elasticity. The pipe is made in lengths of 16 feet of Black Polythene tube, having an outside diameter of 6½" with a wall thickness of ⅜". The ends of the 16 feet lengths are screw threaded and fitted with aluminum collars suitable for connection with the victaulic flexible joint. By virtue of their design the joints permit of some deviation from the straight in the pipes when joined together. Further flexibility, enabling the pipe lines to be gently curved as laid, is imparted by the Polythene piping. In use, the 16 feet lengths of pipe are of such light weight, that one man may readily carry two lengths. The pipe lines are suitable for intermittent operation at up to 100 lbs. per sq. inch pressure.

THE WINDSOR R.C. 100 PRODUCING 6½" DIA. BLACK POLYTHENE TUBE

R.H. **WINDSOR** LTD

LEATHERHEAD ROAD • SOUTH CHESSINGTON • SURREY • ENGLAND

EXCLUSIVE U. S. A. REPRESENTATIVE: F. J. Stokes Machine Company, Philadelphia 20, Pennsylvania.
EXCLUSIVE CANADIAN REPRESENTATIVE: Wilmot Company, Plastics Division, 2488 Dufferin Street, Toronto.

DREW PLASTICIZERS

give you the *Results* you want

What do you require in the plasticizer for your product—Low temperature flexibility? . . . Heat stability? . . . Low cost? . . . Minimum sweat out? . . . Low water extraction?

DREW can help you predetermine the best plasticizer for your needs, and furnish it quickly, economically—with unmatched quality.

Write for new technical bulletin with complete specifications.

DREW PRODUCTS

TECHNICAL PRODUCTS DIVISION

E. F. DREW & CO., INC.

15 East 26th Street, New York 10, N. Y.

CHICAGO PHILADELPHIA BOSTON

26 types and 5,850 sizes —as near as your telephone

EVERY so often, a machinery maker comes to the Timken Company for help with a very special bearing application. Something, he's pretty sure, we've never encountered before.

Almost always, we're able to give him a pleasant surprise. In over 50 years of helping manufacturers with special bearing problems, all the while improving our designs, we've produced an astonishing variety of tapered roller bearings. So many sizes and shapes that the "new" bearing has usually already been designed and made by the Timken Company. So many that the "new" design problem has usually been already solved with the help of Timken Company engineers.

If the people who buy the machines ever have occasion to replace a Timken® bearing, they get the same kind of pleasant surprise. Even when a machine's very old, they can almost always get immediate delivery on Timken bearings for replacement.

Be sure that every bearing you use in the machines you buy or build is stamped with the trademark "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

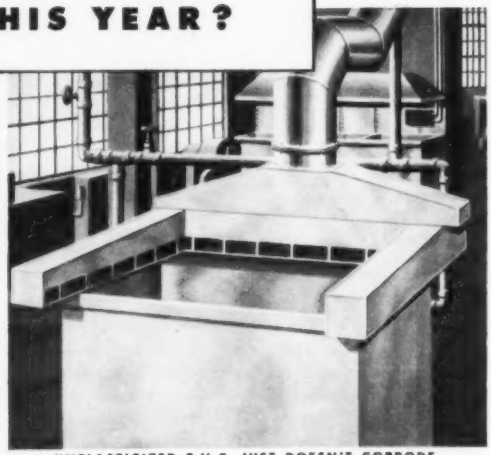
TIMKEN TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ▯ AND THRUST ▯ LOADS OR ANY COMBINATION ✳

HOW MUCH WILL CORROSION

HOW MUCH WILL
CORROSION
COST YOU THIS YEAR?

CHEMICALS CAN CORRODE METALS IN 12 MONTHS OR LESS.



UNPLASTICIZED P.V.C. JUST DOESN'T CORRODE.

Not a cent ... IF YOU SWITCH TO

UNPLASTICIZED P.V.C. MADE FROM FIRESTONE EXON 402-A

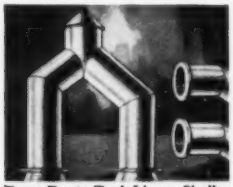
Unplasticized P.V.C. is a new material of construction that is highly resistant to most corrosive elements. In many industrial applications, it has proven to be superior—less expensive—than customary metals. Check carefully the advantages of Unplasticized P.V.C. Then, for detailed information on how this new material of construction can help you in *your* business, consult Firestone Chemical Sales Division.

COST YOUR CUSTOMERS THIS YEAR?

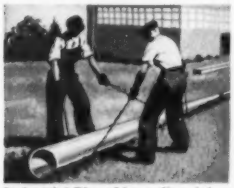
Not a cent... IF YOU SELL THEM

UNPLASTICIZED P.V.C. MADE FROM FIRESTONE EXON 402-A

Implements—Pitchers, scoops, stirrers fabricated from Unplasticized P.V.C. made from EXON 402-A are invaluable in handling corrosive materials. They are extremely light...easy to handle... practically eliminate replacement.

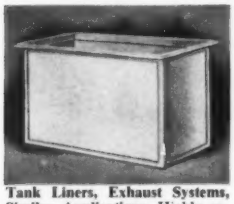


Fume Ducts, Tank Liners, Similar Applications – Unplasticized P.V.C. made from EXON 402-A is ideal for fume ducts and tank liners. It is highly resistant to moisture, acids, oxygen, sunlight, aging and other corrosive elements.



Industrial Pipe—Naturally, piping extruded from Unplasticized P.V.C. made from EXON 402-A is resistant to all types of corrosion. It is extremely light weight in comparison to metal...easier and less expensive to handle.

Storage Tanks—For storage of corrosives, tanks fabricated from Unplasticized P.V.C. made from EXON 402-A are resistant to corrosion and weather, virtually eliminating maintenance and replacement costs.



Tank Liners, Exhaust Systems, Similar Applications—Highly resistant to corrosion, Unplasticized P.V.C. made from EXON 402-A is ideally suited for tank liners, exhaust systems and a wide variety of other industrial applications.

Versatility – Unplasticized P.V.C. made from EXON 402-A can be welded, sawed, sheared, stamped, milled, planed, drilled, embossed, rolled, cemented. It is easily worked on conventional metal and wood working equipment.

AMERICA'S leading manufacturers are becoming more and more *corrosion conscious!* And no wonder. Every year, corrosion costs industry millions of dollars.

That's why Firestone has scheduled an entire series of full-page advertisements now appearing in *Business Week, U. S. News and World Report* and *Corrosion.* (Elements from several of these provocative ads have been reproduced on these pages.)

These advertisements were designed with one thought in mind: to suggest Unplasticized P.V.C. to businessmen as a possible solution to *their* corrosion problems. Results from the first ads in this series indicate that they are stimulating wide interest in this new material of construction.

Have *you* considered ways in which you can adapt this new material of construction to products you now make or could make with your present production facilities?

You can get detailed information on Unplasticized P. V. C. applications by calling or writing:

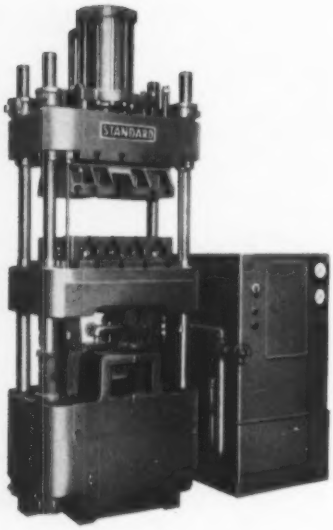
CHEMICAL SALES DIVISION

FIRESTONE PLASTICS COMPANY · POTTSTOWN, PA., DEPT. 14B

Division of Firestone Tire and Rubber Co.

STANDARD
MOLDING PRESSES

offer Six-way savings to make Molding PAY OFF



Do you want to see expanding profits pouring out of your molding presses? Standard does, too; constructs molding presses which give you savings in six ways:

SAVE MONEY—installation is inexpensive—cost of maintenance is lower—there is little or no time out for servicing.

SAVE LABOR—Sequence-type automatic cycle control, with controlled speeds, and accurate adjustment of "breathing", increases output per man hour, permits one operator to run several presses.

SAVE TIME—Fast opening and closing action, automatic change-over from low to high pressure, properly timed and without attention, plus the Sequence-type automatic cycle control, all save precious seconds.

SAVE MATERIAL—automatically controlled speed saves material because it cuts down tendency toward "surge" from old cavities.

SAVE POWER—perfected toggle action, plus low hydraulic pressures, reduce needed power input.

SAVE SPACE—compact, self-contained presses are complete units in themselves—require less floor space.

It's this kind of careful planning and construction that makes Standard—super-standard in the manufacture of compression and transfer molding presses.

DS

DAVIS-STANDARD SALES CORPORATION

16 Water Street, Mystic, Connecticut

Sole Selling Agents for

THE STANDARD MACHINERY COMPANY

Extruding Machines and Molding Presses

at your finger tips . . . FOSTARENE

a new major source for VIRGIN POLYSTYRENE

MUEHLSTEIN
EXCLUSIVE DISTRIBUTORS

● Look to Muehlstein—exclusive distributors of Fostarene—as a new permanent source of virgin clear and colored Polystyrene. Muehlstein's nationwide sales organization and their long experience in this and allied fields assure you of constantly reliable service, stability and efficiency. Write or call for further information.

H. MUEHLSTEIN & CO.
60 EAST 42nd STREET, NEW YORK 17, N. Y.
BRANCH OFFICES: Akron • Chicago • Boston • Los Angeles • Memphis

AICO *Reinforced* MOLDED PLASTICS

They're Extra Strong

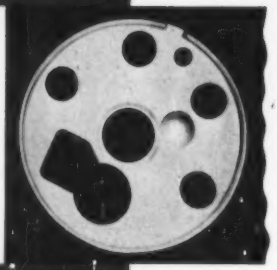
Glass Fiber Preforms offer great strength and dimensional stability for tote boxes, trays, containers and similar articles.

They're Light

Fiberglass Cloth formed into aircraft fairings and fin caps offer exceptional strength-weight ratio. Smooth finish; high flexural, impact and tensile strengths is the perfect combination for many applications.

They're Highly Versatile

Glass Fiber Mat Molding forms radar cover 31" in diameter. Complex shape achieved without hand work or punch press.



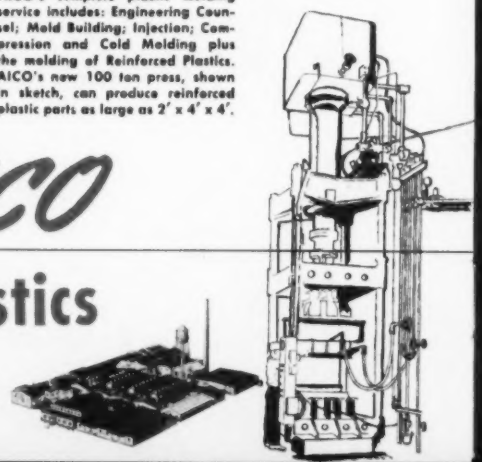
free booklet

GIVES PHYSICAL PROPERTIES
SHOWS TYPICAL APPLICATIONS

Molded Reinforced Plastics such as AICO #100 are non-conductive to electrical current . . . offer extreme heat and flame resistance. In addition to being light, strong and adaptable, Molded Reinforced Plastics are highly resistant to the deteriorating effects of weathering, oils and acids. That's why they can do jobs no other materials can handle . . . cut finishing and fabricating costs without reducing product quality. For all the facts on "What You Should Know About Molded Reinforced Plastics" . . . mail coupon for your free copy of this valuable booklet today.

A Complete Molding Service

AICO's complete plastic molding service includes: Engineering Counsel; Mold Building; Injection; Compression and Cold Molding plus the molding of Reinforced Plastics. AICO's new 100 ton press, shown in sketch, can produce reinforced plastic parts as large as 2' x 4' x 4'.



AICO plastics

AMERICAN INSULATOR CORP.
New Freedom, Pennsylvania

Send me your free booklet on Aico Reinforced Plastics.
☐ Include your free Aico Plastics Applicator.

NAME: _____

COMPANY: _____

POSITION: _____

ADDRESS: _____ STATE: _____

MODERN PLASTICS

THE PLASTICS ERA IN AIRCRAFT

Photo courtesy Grumman Aircraft Engineering Corp

Any article on plastics as applied to aircraft and guided missiles is bound to be merely a progress report. It is twenty years since the first laminated phenolics were used in aircraft; it is fifteen years since the first acrylics glazing was applied to aircraft: it is ten years since the first fibrous glass-polyester reinforced plastics were ordered by officials at Wright-Patterson Field. And progress has been constant. But since the development of jet engines, rocket propulsion, and guided missiles, progress in the use of plastics in aircraft has been almost fantastic.

This "Panel in Print" is an extension of the forum presentation at the Pacific Coast S.P.I. Conference in Las Vegas earlier this year. The Panel will run in two parts, in this issue and in our August issue, with several authors contributing to each. The moderator, Carl R. Lemons, plastics engineer, Douglas Aircraft Co., Inc., has prepared the accompanying introduction to the program. Mr. Lemons' summary will appear next month.

Part One of a "Panel in Print"

PARTICIPATION of aircraft industry technicians and engineers in plastics industry conferences is motivated by the ever-increasing demands in aircraft and missile performance. The use of plastic materials in aircraft and missile construction is born of absolute necessity and requires constant research for new materials and improvement of existing materials to keep pace with component designs.

It is our aim, therefore, to present in this "Panel in Print" a composite picture of our problems as well as a few of the successful applications which may serve as a guide to the plastics industry in reaching our common goal.

In the field of transparent canopies, enclosures, and windows, the requirement that these components be pressurized and resistant to shattering under bullet or projectile impact has created new concepts of material construction and design. One approach to the problem is to use a soft vinyl butyral interlayer to absorb shock and prevent crack propagation from the point of impact. Both acrylic and polyester cast sheets are being used as rigid face sheets but with new emphasis being placed on cast polyester because of its resistance to crazing.

Another approach under research is to stretch acrylic sheet in such a manner as to produce a laminar effect of molecular orientation, which renders the material resistant to crack propagation as well as more craze resistant.

The problem is further complicated by the effects of heat generated by skin friction at high speed and hot air used for anti-fogging

Members of the First Panel on Plastics in Aircraft

THE MODERATOR
Carl R. Lemons
Plastics Engineer
Douglas Aircraft

AIRCRAFT CANOPIES
Curtis R. "Curt" Riley
Process Engineer
Lockheed

COMMERCIAL PLANES
Harold H. Rosenbaum
Plastics Engineer
Consolidated Vultee

PLASTICS TOOLING
Clive E. Blankenship
Material and Process Engineer
Douglas Long Beach Div.

purposes. Curt Riley of Lockheed presents a detailed analysis of the transparent plastics problem and the steps taken for its solution.

In many ways the plastics applications on commercial aircraft are identical to those on military aircraft. However, it is generally found that more emphasis is placed commercially on non-structural components where lower cost and high grade "eye appeal" properties are deciding factors, along with ease of maintenance. Harold Rosenbaum of Consolidated Vultee discusses the types of plastics materials and their functions on commercial aircraft.

The topic of plastics tooling should be of extreme interest to those people who are sensitive concerning the tax dollar allotted to aircraft construction and who are aware of the staggering costs of tooling programs. The use of plastics materials in place of metals not only brings about cost savings in construction time of the tools themselves but in many cases results in less direct man-hours in fabricating metal parts on the plastic tools.

The predominant applications and current research and development in aircraft plastics tools may be divided into two general categories: 1) casting resin applications such as stretch forming dies, drop hammer dies, and other metal forming tools; and 2) laminated fibrous glass applications such as drilling and trimming fixtures, spot welding fixtures, and other "holding" type tools used along the subassembly line. Clive Blankenship, Douglas Long Beach Div., explains the recent developments in the plastic tooling program.

Forming of Polyester Canopies

by C. R. Riley

WITH aircraft requirements turning more and more to nonshatterable materials for transparent pressurized enclosures, it has been necessary to re-evaluate the available materials.

Since the most practical method for creating non-shatterable enclosures appears to be the laminating of rigid plastic sheets with a soft interlayer of flexible polyvinyl butyral, the problem has been one of selecting a suitable material for the outer skins of the laminate.

Naturally, all materials considered for this type of application have certain advantages and disadvantages. In the acrylic field, we have Plexiglas IA, Plexiglas II, Plexiglas 55, and, we hope in the near future, Polymer K, all of which are produced by Rohm & Haas. According to the latest advice received, Du Pont is discontinuing the production of Lucite cast acrylic resin, cast acrylic sheet, and the experimental acrylic material HE5621. Due to difficulties of procurement, M.A.C.A. or Gafite, has not been seriously considered. In the polyester field, we have Selectron 44, produced by Pittsburgh Plate Glass Co., and Sierracin 611, produced by Sierracin Corp.

In our review of the various materials, we found the acrylics to have about the same tensile strength as polyester, approximately 9500 p.s.i., and flexural strengths of 20,000 p.s.i. against 18,000 p.s.i.; also, a higher heat distortion point of about 200° F. compared to 180° F. for polyester material. Acrylics are easier to form, since they are thermoplastic and may be drawn as much as 50% or more in a compound curvature, as compared with only about 10% for the polyesters. However, the factor of service life seems to weigh heavily in favor of the polyester materials because:

1) The polyesters do not seem to craze, either from excess load or from the majority of standard solvents. The plasticizers used in the polyvinyl interlayer of laminated sheet do not seem to affect polyesters adversely in regard to crazing under load.

2) Long time weathering tests show that at 9000 hr., or about one year, polyester laminates carry a usable load of 2000 p.s.i., while acrylic laminates of Plexiglas IA are capable of carrying only 500 p.s.i. This ratio of 4 to 1 is approximately the same as we have found in service life comparisons between the two materials in the monolithic form during the four years that polyester windows have been used in the commercial Constellation. Outdoor weathering tests and actual

flight experience of these four years have indicated that the polyester materials should be considered for laminated fighter canopies.

3) Cleaning solvents customarily used have no adverse effect.

Polyesters also have their faults. The principal detriments are as follows: a) The notch sensitivity of the material is low (1.18 lb. per in. unnotched, and 0.22 lb. per in. notched) as compared with 1.61 and 0.99 for Plexiglas II. b) The heat distortion point is low. c) The cost of the laminated material is higher than the laminated acrylics. d) Difficulty may be encountered in forming to the extreme shapes frequently needed in aircraft design.

Solutions

a) Notch sensitivity was overcome by laminating with a soft polyvinyl core to absorb shocks. This raises the Izod impact value from 1.18 lb. per in. to 7.0 lb. per in. on an unnotched specimen.

b) At this time, the lower heat deformation point of the material is not too great a problem. However, future requirements are expected to be so much higher than any known organic plastics can withstand, that it becomes another separate problem.

c) It is felt that the increased service life of the material offsets, for the present, the difference in additional cost over other materials. However, it will be necessary for manufacturers to reduce this cost when full production is in process.

d) Fabricating techniques which are used to form free-blown acrylic canopies differ greatly from the methods necessary to form polyester parts. Therefore, Lockheed initiated a research program in cooperation with Pittsburgh Plate Glass Co. to develop suitable techniques.

From the experimental program we found that the temperature of 255° F. needed for laminated polyesters creates no trouble in the bubbling of the interlayer, since this temperature is some 20° below the minimum temperature which causes bubbling in the polyvinyl core. While heating the material prior to forming, it has been found necessary to slowly preform the sheet while in the oven. This is done by the use of a canvas sling and necessary pulleys and ropes to lift the sides of the plastic sheet a little at a time while in the oven, until the sheet has reached the form of a half cylinder. Polyesters will not move as rapidly or as easily as acrylics. Therefore, periodic partial bending in 10 or 15 min. cycles, while the sheet is being heated in the oven, aids greatly in obtaining maximum formability. It was found necessary to heat the sheet for 1½ to 2 hr. to obtain sufficient flexibility prior to placing in the die.

(*Continued on p. 164*)

Plastics in Commercial Aircraft

by Harold H. Rosenbaum

DISCUSSION of the use of plastics in a modern commercial airplane, will here be limited to the Consolidated Vultee Aircraft Corp.'s Model 340 Convair Liner, with which the writer is most familiar. Much of the discussion, however, will be more or less applicable to aircraft manufactured by other companies in the field.

In the Convair Liner, plastics find their most extensive use for so-called furnishing items. These are parts and components which cover the internal structure of the airplane and include such things as the seats, baggage racks, flashlight holders, lavatories, buffets, partitions, stowage bins, instrument panels, etc.

Not every one of the foregoing items are made of plastics but the following discussion will clarify this point.

The materials used are 1) copolymer of butadiene acrylonitrile and styrene acrylonitrile; 2) cellulose acetate butyrate; 3) polymethyl methacrylate; 4) vinyl fabrics; 5) fibrous glass laminates; 6) cotton

Ducting fabricated of phenolic coated fibrous glass cloth is widely used in ventilating systems on commercial aircraft

Honeycomb sandwich flooring used in the cargo areas of Convair Liners is protected from wear by an overlay made of a paper base phenolic laminate

Large airplanes, such as the Douglas C-124 Globemaster, present tooling problems for which plastics offer solutions

fabric laminates; and 7) paper base laminates.

Copolymers are used for wainscotting, window frames, flashlight holders, loud-speaker covers, stowage lockers, instrument consoles, magazine racks, and many other parts. The materials were selected because of toughness, ease of forming, patterned surface, and low density. About 225 lb. of formed sheet copolymer are used per airplane.

Butyrate is used only in the extruded form for window curtain tracks, door and panel edging, and fabric retaining strips. The material was selected for these applications for its toughness, dimensional stability, and its ability to be color matched. About 25 lb. of these extrusions are used on each commercial ship.

Vinyl fabrics are extensively used for upholstering and cabin trimming. Each Convair Liner uses about 142 sq. yd. of these fabrics, weighing 150 pounds.

Each window of the airplane is lined with a 0.1 in. thick heat-resistant acrylic sheet which serves to prevent moisture condensation on the inner surface of the glass. Approximately 16 lb. of acrylic is used in each airplane for this particular purpose.

Small amounts of nylon, polyethylene, Teflon, and cellulose acetate are used for water lines, door seals, control handles and knobs, and O-rings. Approximately 15 lb. total of all these materials are used in each airplane.

Fibrous glass laminates made with a modified phenolic resin, are used for sandwich panel faces (doors, partitions, hat racks) luggage compartment liners, exterior ice shields,

(*Continued on p.* 165)

New Plastics Tooling

by C. E. Blankenship

ANNOUNCEMENT was made only a year ago that a new hot melt ethyl cellulose material was being investigated for producing drop hammer dies.

Today, aircraft and automotive industries alike have discovered that this newly compounded thermoplastic material has definite advantages in metal forming application.

We in the aircraft industries feel that it is especially fitted to our needs for low cost, quick-to-produce tooling, for our type of ever-changing production. Five formulations are available, each different in degree of hardness and flexibility. Each of these five formulas has its specific use in producing such tools as: 1) drop hammer dies; 2) double-action forming dies; 3) stretch press dies; 4) hydro press dies; and 5) wedges.

All of these materials are reclaimable at a reasonable cost which is comparable to or less than that of the lowest cost metal. The suppliers will probably be willing to perform this reclaiming process for a service charge.

Two methods of producing drop hammer dies are now in use. One method is to use the hot melt plastic as the punch and Kirksite metal as the die. The other method is to utilize the hot melt as the die and phenolic resin or metal as the punch.

At this time, possibly the greatest use will be to replace, as necessary, lead punches on drop hammer tools already in production.

No exact comparison data is available at this time as to the life differential between the plastic punches and the lead punches, but a reasonable estimate would be that the plastic punch should never need to be replaced. If damage from rough metal edges occurs, repairs may be accomplished in the press in an average time of one hour.

Parts formed on these new plastic drop hammer dies are definitely superior in appearance and workmanship. Many of these parts are formed without aid of rubber pads.

A survey of future applications of this thermoplastic shows that 60% of all such dies can be produced by one of the two known methods.

Savings Factor

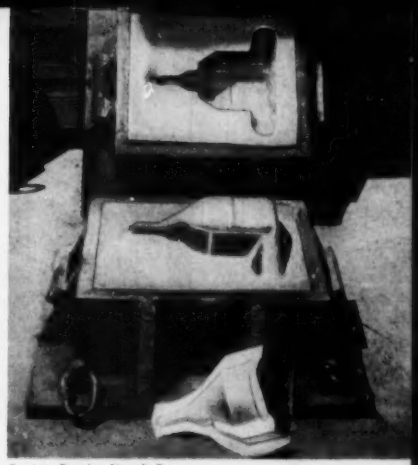
The savings factor is quite large by this fabrication method. Mainly, the reduction of man hours required to grind and fit conventional tools is eliminated, and no material thickness need be considered in casting the die. The weight savings can best be explained by comparison. The thermoplastic weighs 70.5 lb. per cu. foot. Kirksite weighs 432 lb. per cu. foot. Lead weighs 714 lb. per cu. foot.

Tool weight is becoming more critical as the airplane increases in size. Some of the press tools on the C-124 Globemaster, largest cargo and troop transport now in production for the Air Force, are so large that only half of the tool can be handled at one time on existing cranes and carriers. This is readily understood when it is realized that the C-124 airplane gross weight is 185,000 lb.; wing span is 174 ft. and fuselage length is 130 feet.

There are two types of equipment now available to process the new tooling material to a liquid state for pouring. One is an extruding machine and the other is an agitated melting pot. Both pieces of equipment appear to have their advantages and disadvantages. The extruder is the more costly and slower method, but may prove to be the best method to control thermal contraction.

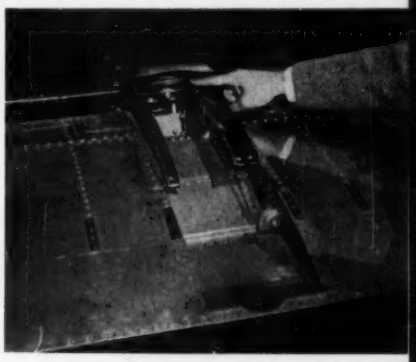
The agitated melting pot is considerably lower in cost, and is much faster in operation, but greater heat must be generated to process the plastic, thereby increasing the possibility of shrinkage. There is still some question as to the necessity for extreme control of shrinkage. We at the Douglas Long Beach Div. feel that nominal shrinkage can be tolerated, and that shrinkage can be

(*Continued on p. 166*)



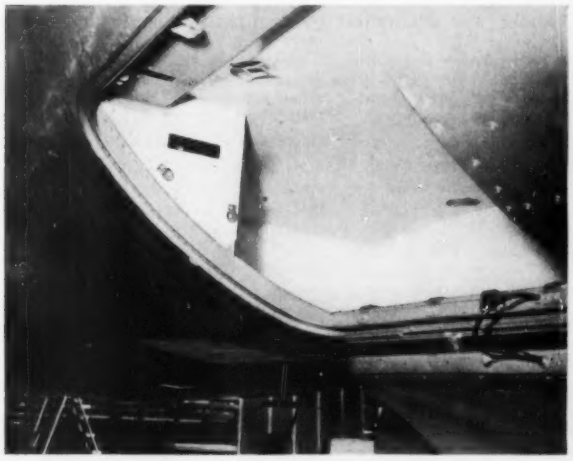
Courtesy Douglas Aircraft Co.

Drop hammer die has phenolic punch; die cavity is made of ethyl cellulose

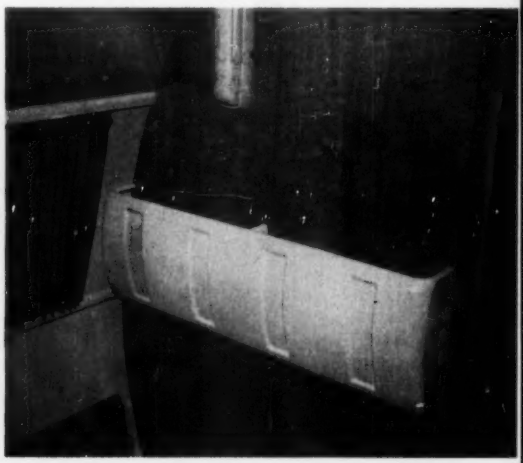


Over 100 phenolic laminate pulleys are used in controls on each Convair

Polyester laminates are used for lining the belly cargo compartment of Convair Liners (below), as well as in oil drip pans, antenna masts, wing edges, etc.



Styrene copolymer sheet is used decoratively in aircraft interiors for wainscotting, flash holders, and magazine racks



Guitars IN PLASTICS

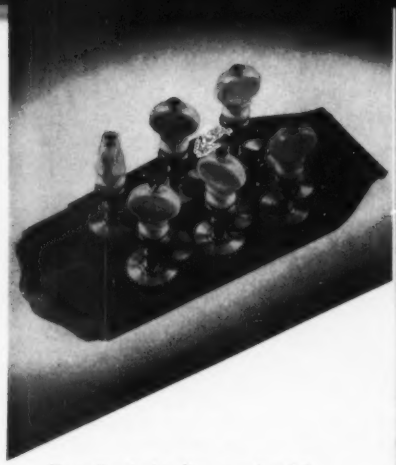
Molded of styrene and ethyl cellulose, new instruments are easy to handle, are unaffected by temperature and humidity

GUITARS have traditionally been made of wood. Skilled craftsmen have fashioned these romantic musical instruments, working slowly and tediously — and expensively — by hand. Now, after 2½ years of intensive research and testing, molded plastics have been successfully adapted to the production of inexpensive, high-quality guitars.

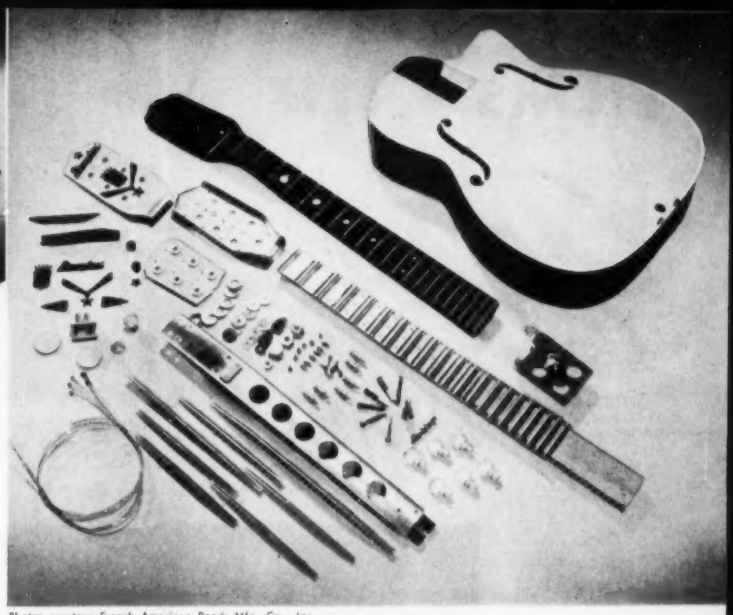
Because plastics lend themselves so readily to modern engineering methods and low cost industrial production, the plastics guitar can be marketed at a price well within the reach of the average purse. More important, plastics produce a good musical instrument with none of the shortcomings of the wooden model. The plastics guitar is easier to handle; it is unaffected by atmospheric conditions; it produces music in perfect pitch; it has good tone; and it is attractive and durable.

Development Program

The plastics guitar is the brain child of Mario Maccaferri of French American Reeds Mfg. Co., Inc., New York, N. Y., and was developed in cooperation with The Dow Chemical Co., Midland, Mich. It was this same teamwork that several years ago resulted in the popular all-plastics



Six guitar tuning keys are inserted into molded ethyl cellulose facepiece



Guitar parts include body of styrene; neck (upper right) and accessories (upper left) are molded of ethyl cellulose

Photos courtesy French American Reeds Mfg. Co., Inc.

ukulele[1]. The phenomenal engineering and business success which the plastics uke enjoyed—and which it still enjoys—were instrumental in the decision to design and produce a plastics guitar.

In the extensive development program that preceded the marketing of the plastics guitar, it was first necessary to produce a suitable working model which could be used for experimentation before the actual cutting of expensive dies.

To mold the body of this working model, an unoriented Styron 475 sheet material was formulated that could be easily and economically heat-formed into shape over wood mandrels. For the long neck of the guitar, a special formulation of tough, elongation-resistant Ethocel ethyl cellulose was injection molded over a metal shell.

[1] See "Ukuleles Go Plastic," MODERN PLASTICS, April 1950, p. 108 ff.

Styrene Body

Once body and neck of the working model had been completed, each of the more than 100 parts which make up the rest of the guitar were carefully studied and modeled by hand. The finished working model was carefully tested for musical qualities and durability. When it had been established that the plastics guitar would fulfill all requirements, the production project was launched.

Tooling, dies, and machinery investment for the productioin of the guitar cost approximately $350,000. Mastro Plastics Corp., New York, N.Y., a Maccaferri-owned subsidiary which does the molding, is now geared to produce up to 500 guitars a day; production is expected to double in the near future.

The body of the production guitar is injection molded of high-impact Styron 475 in two parts—a deep lower half and a top soundboard. The two parts are later cemented.

The ethyl cellulose neck of the guitar is produced in much the same

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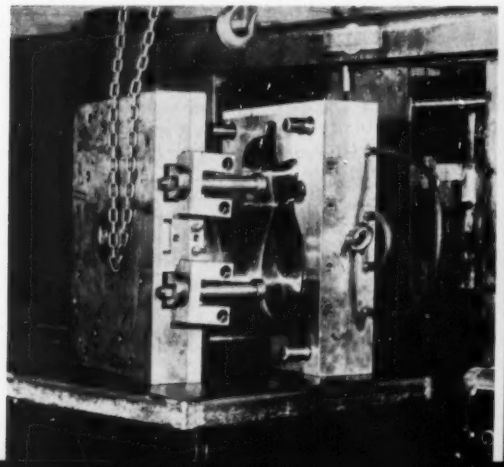
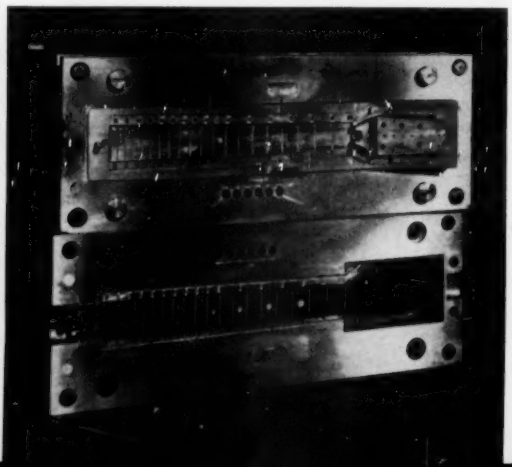
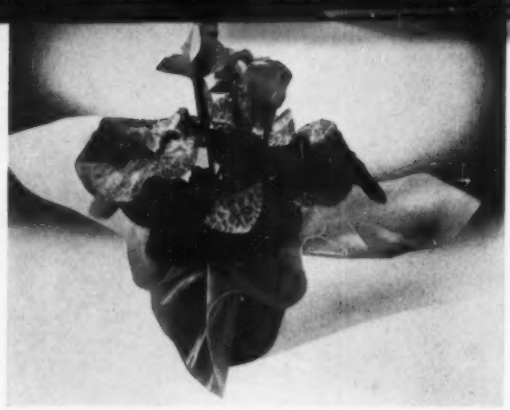
One-piece lower half of guitar body, in rosewood or mahogany color, is injection molded of high-impact styrene in a single-cavity mold



Single-cavity mold is used in producing the tough ethyl cellulose neck. Molded inside the neck is a metal shell containing raised frets



FILMS WITH Green Thumbs



Courtesy Michigan State College

Potted plants, watered and then wrapped in a sheet of polyethylene film, can be left unattended for at least three weeks without ill effects

Pre-cooled tulip bulbs are rooted and grown to maturity in damp moss wrapped in treated vinyl film. A special formulation of plant food and protective chemicals is printed in stripes on the surface of the film

Courtesy Michigan State College

EXCITING new fields for plastics in horticulture have been opened up by the introduction of a treated vinyl film wrap to improve propagation, storage, and shipment of plants as well as by experiments with polyethylene film for retention of moisture and prevention of the spread of disease.

The treated vinyl wrap, which is called Airwrap, was developed by Agri-Plast Corp., Sarasota, Fla., as a means of nourishing and protecting plants or trees during seedless germination. It is made of thin-gage Vinylite film which has been treated with plant food and protective chemicals.

The treatment consists of printing parallel stripes of a special solution directly on the film, using a rotogravure press. The solution contains hormones, vitamins, nutrients, trace elements, insecticides, and fungicides. Printing is done by Toscony Fabrics Inc., New York, N.Y.

Air-layering

The Airwrap method of plant propagation is an improvement on the ancient system known as air-layering. A short ring of bark cut through to the cambium layer is first removed from a branch of the tree that is to be reproduced. This bared section is then scraped clean, rubbed with the green striping on a piece of the Vinylite film, and completely covered with a ball of damp sphagnum moss. The film is then wrapped around the moss and tied to the branch.

When the roots reach the desired stage of maturity, the branch is cut away from the parent tree just below the vinyl wrapping and planted either in the ground or in a pot.

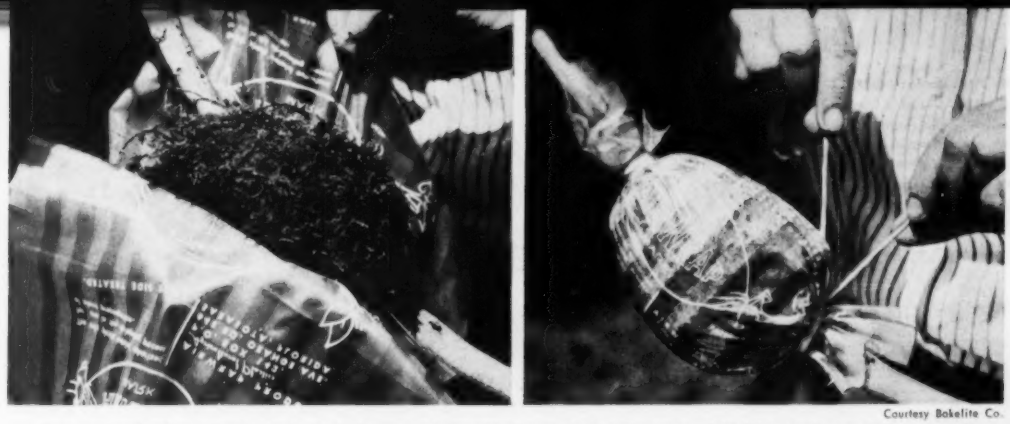
In preparing smaller plants for propagation, a cutting is nestled in damp sphagnum moss set on a piece of the treated film. The film is then gathered into a pouch around the cutting, with the leaves protruding, and is easily fastened with an elastic band.

The treated vinyl film is supplied in bulk for use by large growers and in small kits for home gardeners. The kit contains several sheets of the film, ties for wrapping, and a bag of sphagnum moss.

Rapid Growth

The results in plant propagation that have been achieved with the use of the treated Vinylite film have been little short of amazing.

Plant cuttings are rooted in from four days to two weeks—in as little as one quarter of the usual time. Sizable trees that might otherwise take from five to ten years to grow are said to be produced in as many weeks. Cuttings are virtually assured of taking root; the system has even been proved successful on plants on which root systems have



Courtesy Bakelite Co.

Trees are produced in a few weeks instead of years with the aid of treated vinyl film wrapped (right) around a specially prepared branch covered with moss (left). When roots have developed satisfactorily under the wrap, the branch can be removed and planted

never been propagated by other methods.

As the germination process takes place within the vinyl wrapping, the food and chemicals in the coating are slowly absorbed to nourish and protect the plants. At the same time, the vinyl film retains the moisture in the sphagnum moss, keeps the rooting section warm, and admits just enough light for rapid but uniform growth of roots. Since the vinyl is gas-permeable, it permits free circulation of respiratory gases, and since it is semi-transparent, it permits the formation of roots to be checked without exposing the air-layered branch or the base of the plant cutting.

Shipment

Packaging of plant cuttings for rooting and shipment makes effective use of the treated vinyl film.

In arranging these cuttings, each of the plants is laid side-by-side on the top half of a long strip of film spread lengthwise. A thin layer of damp sphagnum moss is then spread over the ends of the cuttings and the bottom half of the film strip is folded up. Starting at one end, the strip is carefully rolled up into a package with the leaves protruding.

Cuttings—as many as 50 at one time—packaged in this way can be kept moist, alive, and attractively saleable for longer periods of time than conventionally packed plants. The rolls are easier to handle and neater to display and retail than potted cuttings. From the standpoint of the home gardener, they are also easier to transplant because there is less chance of harming the delicate tiny feeder roots in the transplanting process.

Research at Michigan State College, East Lansing, Mich., under the direction of Dale V. Sweet, has contributed much to the development of uses of plastics films in horticulture.

Polyethylene Film

Part of Mr. Sweet's work has led to the perfection of a method of protecting potted plants against moisture loss by using a sheet of untreated polyethylene film. Called "vacation wrap," the film was adapted to the problem of the home grower who is unable to properly attend his potted plants for several weeks at a time.

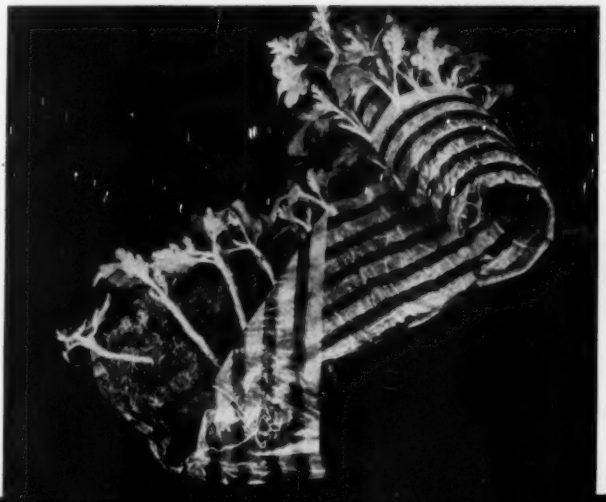
In other phases of horticulture, Mr. Sweet has also done extensive research work on both treated and untreated vinyl and polyethylene films. For example, he has demonstrated that many bulbs can be rooted and grown to maturity in moist sphagnum wrapped in plastic film, and that certain roses can be grown from stumps to mature plants and set out directly from the plastic package.

In one controlled experiment at Michigan State, only three plants of 100 wrapped in polyethylene film were bothered by disease while an entire bench of 60 unwrapped check plants was wiped out.

This work with plastics film may go far toward eliminating the time-honored plant flats and clay pots. It is not impossible that the developments may even lead to planting seeds in plastics wraps, for delivery of growing seedlings to the ultimate consumer.

Small cuttings rooted in damp moss and rolled up inside treated vinyl film can be shipped for long distances without watering and are easier to handle and to transplant

Courtesy Michigan State College



The new Verifax printer, about the size of a typewriter, will reproduce three ready-to-use copies from an original within a minute at a cost of less than 5 cents each

All photographs courtesy Eastman Kodak Co.

Verifax printer in use. Exposure control dial is at upper center of the front

How Kodak

NOTABLE achievements in plastics design and molding make the big news in the announcement of Eastman Kodak's new Verifax Printer which permits multiple copies of letter-size papers to be made in any office in less than a minute.

The printer, made largely from plastics, is about the size of a typewriter, but much lighter in weight, and the way things look now it may well become as definitely standard equipment in any office as a typewriter.

The machine is used with a special new photographic paper and process developed by Kodak to produce multiple copies of letters, memos, office forms, or any typed, written, drawn, or printed originals, including book and magazine pages, up through 8½ by 11 in. in size. Up to three or often more copies of any original can be made from the same sheet of matrix paper at a cost of less than 5 cents each. Copies are same size, black-on-white duplicates which are produced by bringing a sheet of inexpensive typewriter-type paper into close contact with the special photographic matrix.

No Darkroom

Copies produced with the Verifax Printer are ready for use as fast as they are pulled from the machine. Furthermore, they can be produced in any office without darkening the room, and their production requires no special skill on the part of the operator. Unskilled office help, including the office boy, can learn how to produce excellent copies in just a matter of minutes. Copies made by the machine combine the accuracy

Below: Six major and some minor plastics parts are used in the photo copier

Uses Plastics in Photo Copier

New office equipment produces copies of letters and documents in less than a minute. Several plastics are used in both major and minor components

of photography with speed, ease, convenience, and economy of operation. They are exact, long-lasting, and perfectly legible.

The new printer actually combines several operations into one compact unit. Its base provides a tray for the chemical activator used to "develop" the special photographic matrix. The temperature of the solution in the tray is thermostatically controlled by a special heating unit. Only one solution is used. One loading is usually sufficient for a week's use, and no washing, fixing, or other chemical operations are needed with the process.

Above the base there is a storage unit for the paper on which the copies are made, with a storage section also for the special photographic matrix sheets.

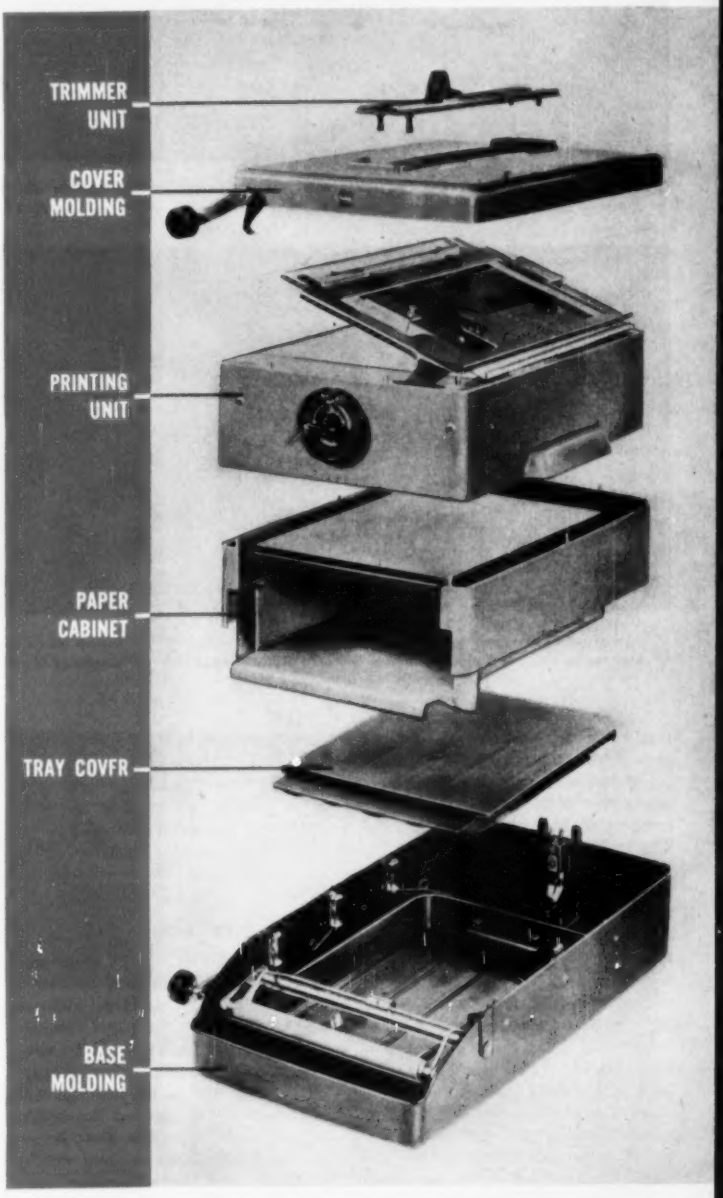
The upper part of the printer contains, in effect, an efficient photographic printer, the lights of which are controlled by a built-in exposure timer. The top of the printer provides a cover for this unit which can be locked down to provide the even all-over pressure necessary to assure good copies. However, when magazine or book pages are being copied, the top can be left open and the required pressure supplied by hand.

The final finishing touch, which in itself is a notable piece of practical design, is an extremely ingenious print trimmer which is built onto the top of the machine.

Speed is Essence

When a letter or other document is to be copied, only 10 to 15 sec. are required for the exposure. Development of the matrix sheet is a simple matter of "floating" it into the activator solution. Then copies can be produced as rapidly as the matrix can be withdrawn from the activator solution in contact with the bond paper as both pass beneath a pressure roller situated just above the tray of chemicals.

Copies are practically dry and

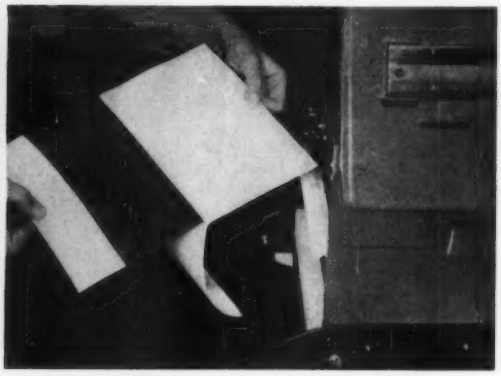


Exploded view of the various units of the printer, with components in place

1 Simplicity of operation is outstanding characteristic. Here a sheet of matrix paper is placed in contact with document to be copied

2 Timer is set after cover is closed. When book or magazine pages are to be copied, cover can be left open and pressure applied by hand

4 Sheet of print paper from storage compartment goes through automatic feeder which rolls processed matrix and print paper together



Verifax matrix is stripped from print paper. Same matrix may be re-inserted in activator to produce additional copies on print paper

ready for use as soon as they are peeled from the matrix.

Fundamental to the new printer is its use of plastics in six major components and some 30 minor parts. The unit is 18¼ in. long, 11¼ in. wide, and 13 in. high. It weighs 24 pounds. The plastic components alone weigh 12.7 pounds. The housing parts are produced from modified styrene, while phenolic, cellulose acetate butyrate Tenite II, polyethylene, nylon, and alkyd are involved in minor components.

The weight of the plastic processor base is 49.76 ounces. The heater used to maintain the solution at the correct processing temperature is a resistance-wire grid sandwiched between vulcanized fabric to form a pod. It is fastened to the underside of the processor base and connected through a thermostat switch to a male plug at the back. The plug used in this instance is molded of alkyd. Above the fluid heater is a processor cover molded of styrene compounds which weighs 20.96 ounces. It is held in place with spring brackets.

Complicated Design

Sitting on top of the processor base, and attached to it by metal spring clips in molded indexed alignment lugs, is the paper cabinet. This cabinet is a particularly notable piece of molding because of its complicated design. The average wall thickness is 0.156 in. and the design is such that very little draft is required. This cabinet molding weighs 45.28 oz. and has alignment lugs molded into top and bottom to facilitate assembly with other components. A spring pressure pad, built into the paper cabinet, presses up on the stack of special matrix paper and maintains a tight stack against light action.

Above the paper cabinet comes one of the heaviest complicated moldings yet done in modified styrene. This is the printer body which weighs 54.4 ounces. Twenty holes are molded into this body to contain the electric light sockets which are of the phenolic pin type. The sockets are so designed that a screw element attaches the wire with no wire-stripping needed. Wiring is parallel, and Tinnerman speed nuts are employed to mount the light sockets in the body holes.

The timer that goes into a large drilled front hole is phenolic-cased,

3 After exposure is made, matrix paper and original are removed and the original set aside. The matrix paper is then floated into activator solution in base

6 Print paper is slipped into slot under trimmer and blade removes excess 2 in. of length. For details of trimmer and its plastic parts, see photos directly below

and is wired in series with the parallel-wired lamp circuit.

Important design factors in the printer body are the hollow handles, rib points to hold the glass pattern for the printer, a slot to contain a package of razor blades for the trimmer, and bosses for the printer top hinges. The printer body has lugs molded on the bottom for alignment to the paper cabinet.

The pressure platen assembly is connected by hinges to the printer body. The printer cover which is attached to the hinge frame completely surrounds the pressure platen. This has on its top the paper trimming device. Nylon cams are used on the cover's locking hook shaft assembly which locks the cover while the matrix is being exposed.

Molded into the top of the printer cover are the end bosses to hold the trimmer assembly. The trimmer guide assembly is of steel and carries the trimmer knife assembly. Paper is inserted under the trimmer assembly between the bosses and up to molded stops, then the knife is slid across the steel track to trim the paper to standard size.

Trimmer Knife

The trimmer knife assembly is a unique piece of product design. It is a two-part Tenite II molding weighing 0.61 oz., incorporating a blade holder which receives blades without danger to the operator by utilizing a standard Schick injector razor device. The unit comes equipped with a blade in place and a spare cartridge of Schick blades in the molded slot in the back of the printer body. Discarded blades drop through a slot underneath the trimmer where they remain harmless. They may be taken out, however, by removing the trimmer unit every ten years or so. The trimmer blade handle is assembled by cementing the parts over the blade holder.

The bearings used in the squeegee rollers, which assure contact between the matrix and the bond paper as the matrix is withdrawn from the activator solution, are made of molded nylon. The strain relief bushings for the back of the timer are black nylon moldings. Polyethylene bottles for preparing the activator solution and a rubber tube fitted

Left: Trimmer knife assembly is molded in two parts which are later cemented together over a metal blade holder case

Right: Completed trimmer assembly showing how cutting blades are changed by use of a blade replacement unit

Right: Top view of molded paper cabinet for Verifax printer. For relationship of this piece to other plastics parts of the unit, see the exploded view on p. 81

Left: Bottom view of paper cabinet. Average wall thickness of this piece is 0.156 in.; weight is 45.28 ounces. Molded-in lugs on both top and bottom provide for alignment of cabinet with base and printer body

with Tenite II end pieces for loading and unloading the solution from the processor are supplied with the unit.

This machine has been thoroughly tested under actual field conditions and received enthusiastic approval. It is now being placed in mass production for which a large market is already assured. Due to production limitations at the outset, however, it is likely that the new Kodak Verifax Printer will for some weeks be in short supply. Plans are being made, however, to meet demand in months ahead. The printer will sell for $240.

Credits

Mold design and molding of principle structural parts by Erie Resistor Corp., Erie, Pa.

Plug by Alkyd Products Corp., Brockton, Mass.

Electric sockets by Union Insulating Co., Inc., Parkersburg, W. Va.

Timer by M. H. Rhodes, Inc., Hartford, Conn.

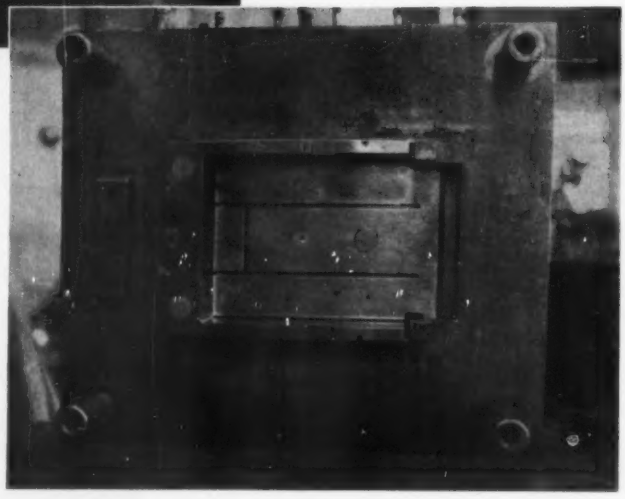
Molds for the processor and processor cover by Molds and Manufacturing Corp., Buffalo, N.Y.

Molds for the paper container, printer, and printer cover by Gougler Machine and Tool Co., Kent, Ohio.

Nylon bearings by Quinn-Berry Corp., Erie, Pa.

Black nylon strain relief bushings by Heyman Mfg. Co., Kenilworth, N.J.

Above: Force-plug half of mold for producing the paper cabinet piece, with one of the pieces held in position of removal. Design of molded part is such as to necessitate very little draft



Right: Cavity half of mold. By ingenious mold design, complicated molded part (see photos at top of page) is produced which simplifies assembly operations. On this job, end user chose complications in the early stages of mold construction to simplify final assembly

HYATT AWARD

IN an unusual shipboard ceremony, Dr. Howard L. Bender, assistant director, Research and Development Dept., Bakelite Co., a Div. of Union Carbide and Carbon Corp., received the twelfth annual John Wesley Hyatt Award "for achievement of wide importance to the plastics industry."

The presentation was witnessed by more than 500 members of The Society of the Plastics Industry, Inc., attending the fourteenth annual meeting of that group being held aboard the Q.T.E.V. *Queen of Bermuda* during a convention cruise. Gordon Brown, president of the Society and a member of the award committee, made the principal address at the ceremonies. The award was presented by Capt. Leslie F. Banyard, commanding officer of the *Queen*.

Dr. Howard L. Bender (left) is presented with the twelfth annual Hyatt Award by Capt. Leslie F. Banyard of the Q.T.E.V. *Queen of Bermuda*

Dr. Bender received a gold medal and one thousand dollars in recognition of his lifetime of research and development in the field of phenolic resin molecular structures.

His continuous research, which began 30 years ago, has contributed to improved manufacturing techniques using phenolic resins in the fields of laminating, bonding, adhesive, coating, and molding compounds.

In his probing of molecular structures, Dr. Bender isolated six isomers, three of which are found in phenolic resins. The traditional phenolic resin contains these three isomers, linked in random fashion, but predominately 2,2′-diphenol and 4,4′-diphenol.

Dr. Bender's work led to a method of producing resins consisting mainly of 2,2′ linkage, the structure of which he had found had an extremely rapid cross-linking rate when hardened with hexa. This meant that at last phenolic materials could be produced with extremely fast speed of cure. Following this development, Dr. Bender evolved a method of obtaining a high content 2,2′ phenolic resin on a practical commercial basis.

Dr. Bender was born in Williamstown, W. Va., on September 14, 1893. He was graduated in 1911 from Sand Hill High School (Marietta Township, Ohio), and at once became a rural school teacher.

He entered Marietta College in 1913 on a one-year tuition scholarship and determined to become a high school teacher of chemistry. Financing his four-year education by revenues from a summer farm, Dr. Bender was graduated from Marietta College in 1917 with a B.A. degree, and was valedictorian of a class of 110. An M.A. degree was granted later, upon completion of a thesis.

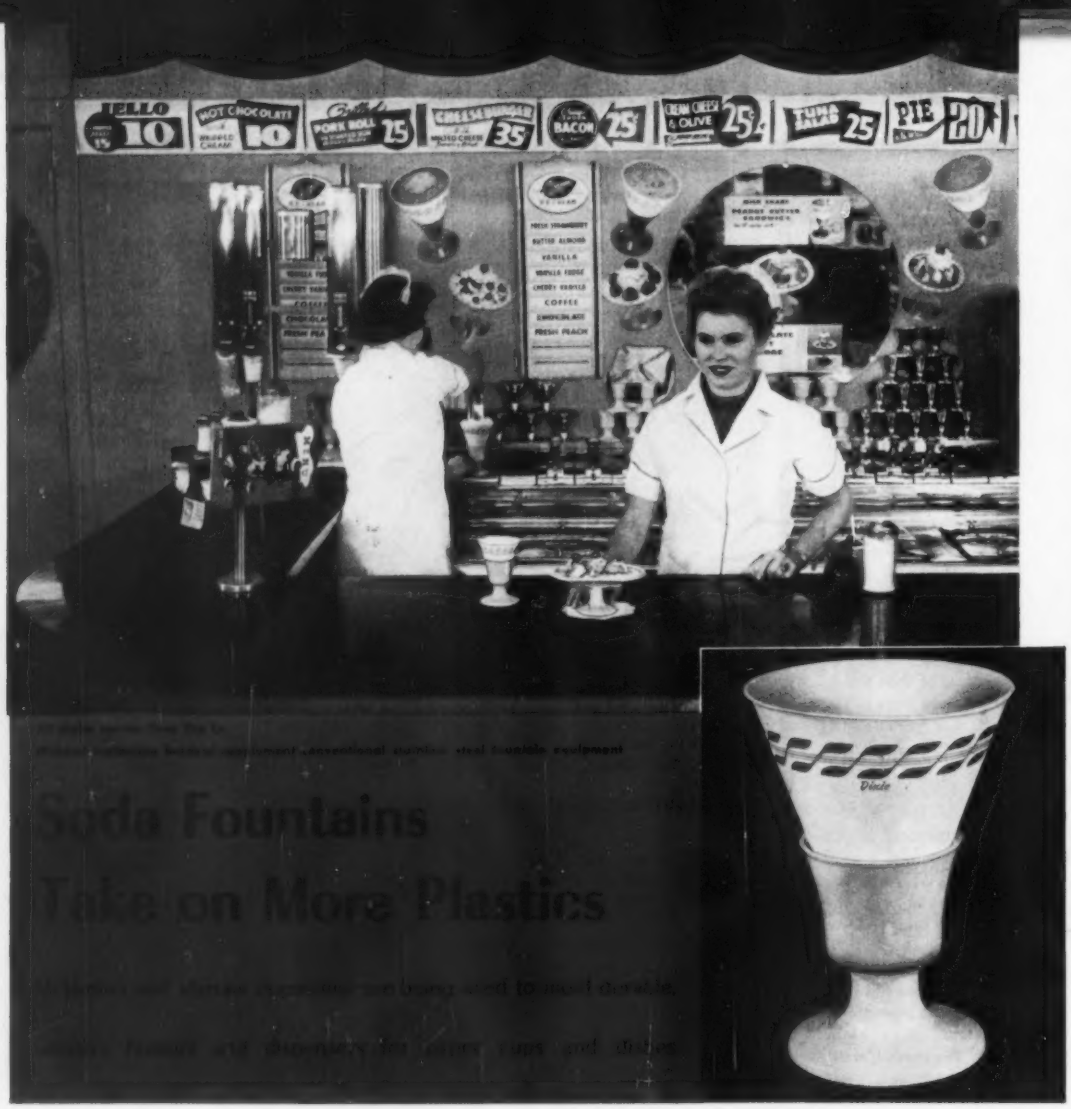
He was appointed to the Drury Fellowship at the Case School of Applied Science in Cleveland, Ohio, in September 1917, married the following year, and was graduated from Case in 1919 with a B.S. degree in chemical engineering. He obtained his first position in a research laboratory with The Dow Chemical Co., Midland, Mich. Two years later, he was appointed instructor at Marietta, and a few months afterward was awarded the Bakelite Fellowship at Columbia University, to work under Dr. Leo H. Baekeland for the 1922-'23 school year.

Granted his Ph.D. degree in chemical engineering in 1923 by Columbia University, Dr. Bender began his employment in the same year in the Bakelite Research Dept. at Bloomfield, N.J., and started his work in the field of phenolic condensation polymers there.

The Hyatt Award, of which Hercules Powder Co. is the patron, was named in memory of John Wesley Hyatt, the "father of the plastics industry." It was Hyatt's work with cellulose nitrate and camphor in 1867 which resulted in the making of the first thermoplastic, celluloid.

A distinguished committee, composed of outstanding leaders in arts and industry, selects the winner each year.

Members of the John Wesley Hyatt Award Committee for 1952 were: Richard F. Bach, consultant in industrial arts, Metropolitan Museum of Art; Palmer W. Griffith, American Cyanamid Co. and 1951 medalist; Mr. Brown; Dr. Farrington Daniels, president of the American Chemical Society; Waldemar Kaempffert, science editor of *The New York Times;* Dr. James R. Killian, Jr., president of the Massachusetts Institute of Technology; and Dr. Edward R. Weidlein, director of the Mellon Institute of Industrial Research. William T. Cruse, executive vice president of the Society of the Plastics Industry, is secretary of the committee.



Durable melamine holder is designed to hold cone-shaped paper cups firmly in place

SODA fountains are excellent proving grounds for plastics. In applications that range from serving trays to syrup jars, plastics units have already replaced metal or porcelain parts—and the trend continues.

Now another forward step has been taken by Dixie Cup Co., Easton, Pa. That company has announced the development of a new series of molded melamine holders and molded styrene copolymer dispensers, especially styled to accommodate the cone-shaped paper cups and dishes which it manufactures.

Designed as a lower-cost supplement to a line of stainless steel equipment, the plastics units have already proved comparable—and in many instances, far superior—to the metal and all at a cost that fits into the budget of even the smallest fountain operator.

Attractively colored, light-weight, and durable, the holders and dispensers are as practical to use behind the counter as they are a handsome addition on top of it. Equally as important, to fountain clerks and customers alike, is that the units can be easily and thoroughly cleaned in high-temperature water.

Melamine Holders

The pastel-colored Melmac melamine holders are available in three different sizes to accommodate the various sizes and shapes of paper cups and dishes. The smallest unit in the set will hold all sizes of the cone-shaped paper Dixies and is

of patented "step" design which resembles an inverted wide-waisted bell. Northern Industrial Chemical Co., South Boston, Mass., does the molding.

The two larger units—one for sundae dishes, the other for the longer and wider super-sundae dishes—are both styled with matching "step" design, starting with a wide diameter at top, tapering down to a thin waist and relatively long stem, and then out again to a flat circular base. The super-sundae dish holder is molded by Northern Industrial Chemical Co.; the sundae dish holder by Prolon Plastics Div., Prophylactic Brush Co., Florence, Mass.

In choosing the material for the holders, design engineers of Dixie Cup Co. based their decision on the ability of the material to meet the tomers. At the same time, the holders are light in weight and do not produce noisy, metallic clatter, during handling.

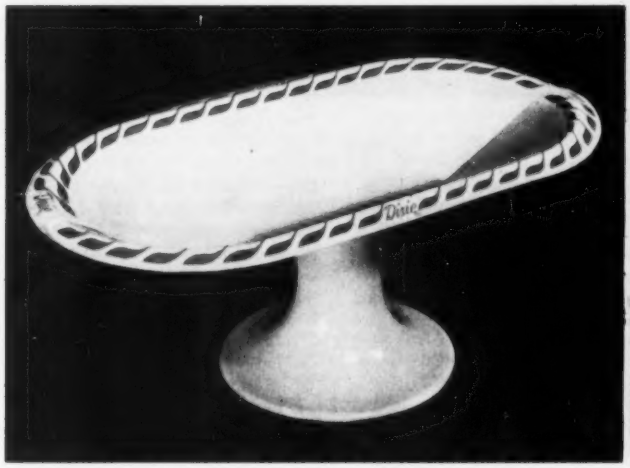
To maintain the high sanitary standards that the American public demands in any dining establishment, the holders can be washed after each use in high temperature water without damage; syrup, ice cream, or other foodstuffs can be removed quickly from the surface.

Design

The holders are available in three pastel shades—blue, buff, and grey—and have proved a popular, eye-appealing addition to the less colorful equipment normally used at a fountain. The integral color will not fade despite frequent washings in hot water; when dry, the holders to allow a waitress to carry two or three of the lightweight holders without difficulty.

A rubber insert, which is snapped manually into place, is housed in the wide waist of the small paper cup holder. When the empty holder is pressed against a stack of paper cups, the rubber insert grips the paper so that it is lifted off the stack and is ready for service. Three triangular-shaped raised bumps are molded around the inside circumference of the holder to keep the paper cups stable and firm when filled.

In the sundae and super-sundae holders, steel clips produce a "pinch-grip" to pick up the paper dish quickly with a minimum of pressure and anchor it firmly into the holder. The two clips are riveted to opposite



Another holder, styled with an extra wide mouth, is for oval super-sundae dishes. Steel clips riveted to the inner surface provide secure anchorage

Third holder in the series accommodates sundae dishes. All three units are available in popular pastel colors

three major requirements for any soda fountain equipment: 1) practicality and efficiency in use; 2) ease of cleaning; and 3) customer eye-appeal.

In all three phases, melamine proved completely successful.

The durability of unbreakable, chip-resistant melamine—emphasized so dramatically in heavy-duty dinner ware applications—is especially desirable in a cup holder that must stand up under rough usage by dishwashers, waiters, and cus-have a long-lasting gloss that does not need constant polishing. This marks the first time a paper-cup manufacturer has offered equipment in a choice of colors.

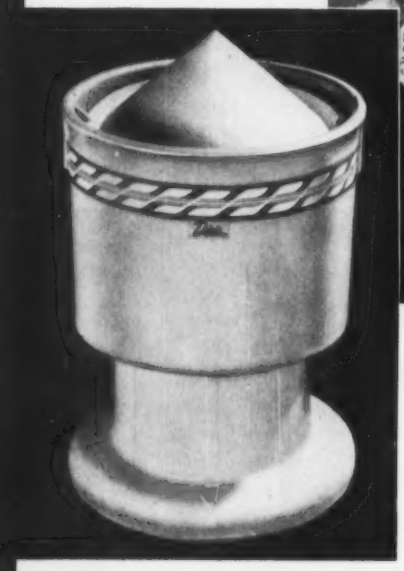
Appearance-wise and convenience-wise, the design of the holders was carefully worked out to complement the practical advantages of the melamine material.

The slender stem, for example, while attractive in styling, is still sturdy enough to support the unit and its contents, and thin enough ends of the inside surface by a precise operation that necessitates holding the rivets to close tolerances. If the rivets are too short, the clips will not hold; if the rivets are too long, they interfere with pick-up of the paper dish.

Styrene Dispensers

The paper dish dispensers, molded of Bakelite's C-11 styrene copolymer by Norton Laboratories, Inc., Lockport, N.Y., represent a different approach to the specialized problems

Melamine dish holder is loaded directly from styrene copolymer dispenser by pressing down and twisting. After use, holder can be washed in high temperature water without any danger of surface burns or fading colors



Dispensers (for sundae dishes, above; for super-sundae dishes, below) are molded of styrene copolymer in pastel colors to match the holders. Both dispensers are durable, easy to re-fill, and can take frequent washings

which arise in the soda fountain industry. The function of this unit is to serve as a housing for a stack of paper dishes.

Unlike the melamine holder, however, the dispenser is not handled as continuously nor does it require too frequent washings. By selecting the styrene copolymer for this application, the design engineers evolved an economical unit that would easily withstand the rugged knock-about treatment of soda fountain use and resist corrosive elements that might splash or otherwise come in contact with the dispenser.

Styrene copolymer has sufficiently high heat resistance to permit it to be washed in hot water. Like the holders, it has an excellent surface finish, is light-weight, and can easily be wiped clean.

Assembly

The dispensers are offered in a buff or gray color to match the melamine holders and are available in two sizes—a small unit for sundae dishes and a larger unit for super-sundae dishes.

The dispensers are molded in three sections—a sturdy pedestal, which is the same size for both units; a concave jaw, molded to the shape of the paper dish and fastened to the top of the pedestal; and a deep round barrel which fits over both jaw and pedestal.

In use, the paper dishes are placed on top of the jaw and inside the barrel. The dishes are held in place by two molded lugs cemented into opposite ends of the barrel. As each dish is pulled out from under the lugs, the barrel automatically lowers on the pedestal and the lugs engage the edges of the next paper dish.

To facilitate disassembly of the dispenser for washing, the entire unit is held together by only one screw and wing nut located in the center of the jaw.

In these developments, plastics have made possible low-cost, colorful fountain equipment that has already been well accepted by the trade. Dixie will continue to produce its line of more costly stainless steel equipment, but foresees that the inherent advantages of the plastics units will result in a steadily rising sales curve.

SPRAY AND WIPE

One-stroke window cleaning device utilizes squeeze bottle equipped with squeegee held in polyethylene spray head

POLYETHYLENE "squeeze bottles" are coupled with molded polyethylene parts to provide a new, handy device for cleaning windows. The unit, developed by Squeezit Corp., Morris Heights, N.Y., sprays, cleans, and wipes a window dry in a single stroke.

In addition to the flexible squeeze bottle, the assembly includes a molded polyethylene head which screws on to the neck of the bottle, an extruded polyethylene tube, a rubber squeegee attached to the head, and a molded phenolic closure.

To use the window cleaner, a molded polyethylene lever which closes over a small square hole in the head is first flipped open with the thumb. The bottle, filled with liquid cleaning solution, is then held near the window and squeezed, forcing the liquid up the polyethylene tube and out through the square hole. After the window has been sprayed, the squeegee is used to wipe the window dry.

Molding and Assembly

The polyethylene bottle, head, and lever, are molded by Plax Corp., Hartford, Conn. The squeezable bottle is a standard 4½-fl. oz. model, molded in a light green color; the head and lever are injection molded in yellow in a 16-cavity combination mold that produces pieces for eight units with every cycle.

The head is molded as a 1¼ in. high hollow unit with a cylindrical center section, in which screw threads are produced during molding. By lending support to the flexible walls of the head, the center section adds rigidity to the part.

Also molded into the head are a narrow slot at the top of the head and a circular projection located on a flat triangular surface midway between the top and the bottom of the head. Both of these additions facilitate the assembly of the unit. The slot accommodates the metal base of the rubber squeegee, which simply slides in for a snug fit, and the circular projection accommodates the round hollow end of the lever by a snap fit.

Operation

The lever itself is molded with a long arm that extends just far enough beyond the edge of the head to allow it to be pushed back and forth by the thumb. When the lever arm is pushed to the right, part of it completely covers the square hole molded-into the round projection; when pushed to the left, a large molded-in opening alines with the square hole, thus allowing the liquid to be sprayed through. Another opening, triangular in shape, is molded-into the head directly below the square hole to accommodate the polyethylene tube that carries the liquid to the hole.

To complete the unit, an illustration of the product, the trade name, and directions are silk-screened in matching yellow on the bottle.

Courtesy Squeezit Corp.

Liquid sprayed on window by squeezing bottle is wiped off with squeegee

Components of unit (left) include polyethylene bottle, phenolic closure, squeegee, extruded polyethylene tube, and molded polyethylene lever and head (right, top to bottom)

All photos courtesy The Goodyear Tire & Rubber Co.

Raincoats made of perforated vinyl film which lets air in but keeps water out are available in clear taffeta for women (left) and tan gabardine for men (right)

Vapor formed by dry ice in water escapes in tiny streams (faintly visible at top, above) to demonstrate porosity of new vinyl film. One application of new material is in cuff protectors (below)

NEW VINYL FILM THAT 'Breathes'

Tiny mechanically produced perforations permit air transmission, yet the film remains water resistant

LONG awaited by vinyl film fabricators, by retailers, and by consumers, a vinyl film made porous to air but not to water is now being introduced by the Films, Foams, and Flooring Div., The Goodyear Tire & Rubber Co.

The new "breathing" film, designated "porolated" Vinylfilm, has as many as 64 tiny holes per sq. in. produced mechanically, at high speed, and with great accuracy. The holes are large enough to permit a high rate of air transmission through the film yet small enough to enable a bag made of porolated film to hold water, thus making the material eminently suitable for use in raincoats, baby pants, mattress and pillow covers, stenographers' cuff protectors, furniture covers, and many other things.

The principle of mechanical production of an air-porous film has been adapted by Goodyear to its regular Vinylfilm as well as its boilable films and its lanolin-containing films for the infants' wear field. The regular plasticizers and stabilizers used by the company in its quality film production are used in the new material. Most of the porolated film production will be in the 4- to 8-mil range and, while higher and heavier gages may be made at a later date, none will be offered at less than 4 mils.

(*Continued on p. 169*)

BLAST OFF!

Futuristic possibilities of interplanetary travel have opened a tremendous market for toys that only plastics can satisfy

THIS year is "space year" in the toy industry. The exciting possibilities of interplanetary travel have captured the imagination of the younger set and space toys—in the form of strato-jet planes, rockets, space guns, and helmets—are finding eager acceptance in the juvenile market.

The space travel theme has emerged as one of the biggest and most profitable sales stimulants the toy industry has ever seen. And the more the sales curve rockets upward, the greater grows the demand for plastics. Plastics were the major material in the construction of the very first space toys that appeared on the market—and plastics have maintained that position ever since.

The contribution of plastics to the freshness and originality of design that characterizes the space toys has been an important one. From the standpoint of the manufacturer, the materials represent the solution to problems of economical production and ease of assembly. More important, from the standpoint of the parents of the young space man, plastics mean durability, safety, and high sanitary standards.

Expansion

Leaders in the toy industry predict that the space theme will continue to increase in popularity for the next two to three years. After this, it will level off on the sales curve in the upper brackets usually reserved for the perennial favorites —cowboys and Indians, cops and robbers. Underlining this prediction of expansion are two basic facts.

First, none of the stimuli which originally gave birth to the space fad—TV programs, science-fiction comic books, and space travel movies—has shown any sign of diminishing in scope. Rather, under the impetus of interest displayed by the adult population in the scientific possibilities of the Atomic Age, they show every indication of increasing.

Secondly, census figures of population growth point to record sales for toys of all kinds. The rising birth rate, which resulted in a new high of 4 million births in 1952, assures a potential market of some 43 million children within the next 10 years.

In stimulating sales for space toys, the advantages of plastics take on an even added importance. The need for durability is implicit in the fact that many of the space toys are in the form of helmets or goggles that are worn over the head or near the eyes; the bright integral colors of plastics are especially adaptable in space toys for blending with the child's conception of futuristic styling; the ease with which plastics toys can be cleaned facilitates mother's job after Junior has spent a hard day among the "guided missiles" of a space battle.

Equally important—especially to the toy designer—is the flexibility of styling that plastics allow. In comparison with other playthings, space toys are unique in that the child will accept only those products that meet his own rigid standards of realism. Under the influence of comic books and TV, children have been given a definite conception of the proper dress and equipment for the interplanetary space traveler—and will be satisfied with nothing else.

According to well-established interplanetary lore, a space helmet is a transparent globular or cylindrical enclosure that fits completely over the head. Since this is the standard on which the majority of helmets are based, the choice of plastics—usually either acetate or vinyl—solved many problems for the toy designer.

Acetate Helmets

These transparent helmets fulfill the all-important safety requirements in regard to fire resistance. They are durable enough to withstand the abuse of playtime hours;

Courtesy Mil-Din Co.

Cylindrical space helmet, fabricated of transparent, durable acetate, weighs only 5 ounces

Courtesy Arant Plastics

Courtesy Eastman Chemical Products, Inc.

Headgear for interplanetary travel takes many forms. One helmet (left) is frabricated of vinyl in bubble-like shape . . . another (right), molded of acetate, adds vinyl jet tanks for realism . . .

Courtesy Captain Video Television Productions

Courtesy Banner Plastics Corp.

. . . and a third (left), formed of acetate, has a transparent, hinged facepiece. In the realm of futuristic space hats, one molded styrene version incorporates a pair of rotating antennas

they are light in weight for comfortable wear. They are optically clear for non-distorted visibility.

Three shatterproof acetate helmets currently being marketed are distinguished by original styling in line with accepted standards for interplanetary headgear.

The Space Patrol Helmet, molded of Tenite I cellulose acetate by Beemak Plastics, Los Angeles, Calif., is modeled after a type in vogue on a popular TV show. More than 1 ft. in diameter, the unit is molded in two pieces which are cemented together along with a reinforcing strip of bright red acetate. Rectangular openings at back and front allow for ventilation and speaking. As a final realistic touch, inflatable red and blue tubes and "astral jet pack tanks," fabricated of vinyl, are provided with each helmet.

Another acetate helmet, modeled after still another TV space traveler, is formed by Plaxall, Inc., Long Island City, N.Y., for distribution as a premium. Material is supplied by Eastman Kodak Co., Rochester, N.Y., and Joseph Davis Plastics Co., Arlington, N.J. Production details are given on pp. 106-9 of this issue.

The third of the acetate helmets, fabricated by Mil-Din Co., Brooklyn, N.Y., from Monsanto Vuepak, is cylindrical in shape. The 5-oz. unit, which includes a shoulder piece as well as the helmet, is shipped to the customer unassembled. The cylinder is manufactured a little oversize and then shrunk to fit. To facilitate ventilation—and also allow the child to eat while wearing the helmet—a circular opening is cut in front. As the air enters this opening it circulates upwards through the cylinder and out through another opening at the top.

Vinyl Helmets

Also designed to ride the crest of space toy popularity is an interplanetary helmet fabricated of clear Bakelite Vinylite sheet by Arant Plastics, San Francisco, Calif.

The bubble-shaped headpiece, which mounts securely on the shoulders with durable Vinylite cross-straps, is adjustable for children of all sizes. Ventilation is provided through four vertical slits cut into the front of the headpiece. A final futuristic touch is a flexible metal antenna capped with a vinyl plug.

Space Hats

In the styling of space hats, which do not enclose the head, the juvenile demand changes. Instead of transparency, the child now wants bright, striking colors that lend added impact to streamlined styling.

For the designer, too, this category presents a different problem. Since there are not as many TV or comic book precedents to follow, he can give free reign to his imagination.

The Flying Saucer Hat, manufactured by Sidney A. Tarrson, Chicago, Ill., is an example. Molded in contrasting colors of tough styrene, supplied by Catalin Corp., the hat,

Another space hat, molded in bright colors of rugged styrene, includes simulated flying saucer and whirling propellers

which is held on by an elastic chin strap, incorporates a simulated flying saucer complete with spinning propellers, fins, and a model of an outer space pilot sitting in the cockpit.

Another space hat, also held by an elastic chin strap, is molded of styrene by Banner Plastics Corp., Paterson, N.J. This hat is equipped with a sleek rocket ship fastened to the bell-like top of the unit, hinged goggles that flip up and down, and cone-shaped radar antennas that rotate in any desired direction.

Guns and Gadgets

While realism in accordance with TV standards is still uppermost in his mind, the space-conscious youngster pays particular attention to the external trappings of the toy. In the realm of space guns, for example, no self-respecting small-fry space man would even consider a gun that was not fully equipped with blast shield, cooling fins, electronic chambers, and a host of similar pseudo-scientific attachments.

One plastic gun that illustrates this "space emphasis" is the 27 in. long "auto-sonic" rifle, molded of Dow high-impact styrene by U.S. Plastic Co., Pasadena, Calif. Only with plastics could this gun have been produced as a durable, futuristically styled, and brightly colored unit in an inexpensive price range.

The two-tone bazooka-shaped rifle is fully equipped with rocket-type butt, double grips, and telescopic sights. Its 17 parts are quickly and easily cemented together.

U.S. Plastic Co. also molds a set of "cosmic" play phones, using Koppers DC-32 styrene. The phones consist of two halves cemented together. The front half has a molded-in grillwork and built-in siren; the back half has a molded-in hole through which one end of the speaking cable is inserted. A handy clip for securing the phone to belt or wrist is attached to the back half.

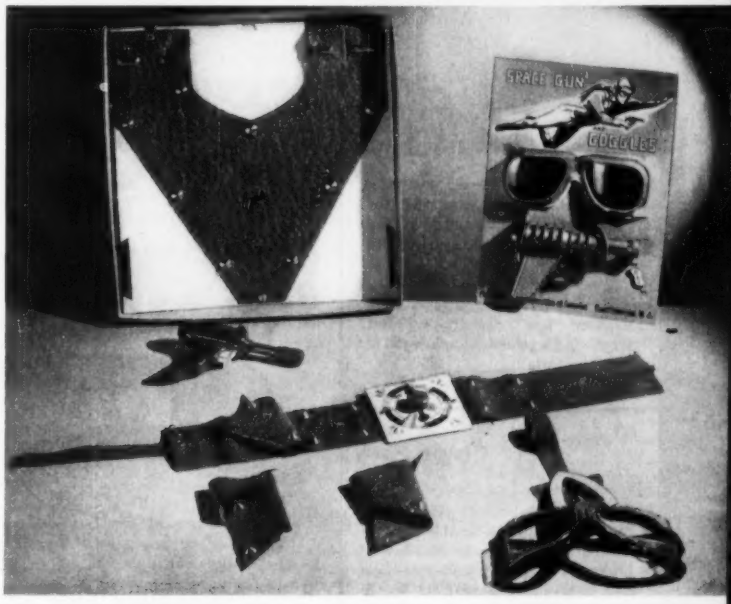
Target Pistol

Styrene is also used to advantage in two other space weapons—a double-duty target pistol and a translucent water gun.

The Ray-O-Matic pistol is molded by California Moulders, Inc., El Monte, Calif., using Dow high-impact styrene. All the parts for two

(*Continued on p. 170*)

Red and yellow space gun is made up of 17 molded styrene pieces cemented together. Streamlined design of gun incorporates fins, telescopic sights, rocket-shaped butt, and double hand grips



Included in the trend towards futuristic styling of toys are a space outfit (above, left), consisting of vinyl uniform, styrene gun, and acetate goggles, and a space set (above, right) which includes a styrene pistol with acetate goggles set in a styrene frame. Space gadgets and gimmicks (below)—all molded of styrene—range from action toy, earphones with built-in sirens, and space men (top row) to knife and flashlight (foreground)

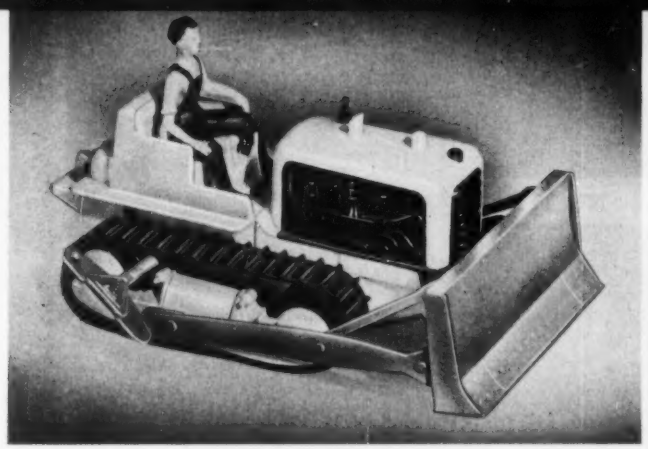
Handsome gun cover made of Velon fabric is a practical accessory on rugged hunting trips. The vinyl cover is stain resistant, impervious to grease and oil, and will not crack or become brittle in cold weather. It is a product of Bradley E. Grimes Co., Inc., West Collingwood Heights, N. J.

Lightweight saddle, fabricated of tough Vinylite sheeting attached to a leather base, is designed for racing jockeys. Water resistant, easily cleaned, and a comfortable seat when riding, the saddle is said to have unusual resistance to slipping and sliding. It is available in three sizes from Arcaro and Dan's Saddlery, Inc., Elmont, L. I., N. Y.

PLASTICS

Plastics contribute to civilian defense preparations in the form of a lightweight helmet molded of lustrous Tenite II cellulose acetate butyrate. The helmets—available in white or green—are highly impact-resistant and will not rust or corrode. A light, adjustable harness is riveted to each hat. Molded by Como Plastics, Inc., 1703 Keller St., Columbus, Ind.

Transparent mittens, fabricated of 0.0015-in. polyethylene film on special heat-sealing equipment, protect the housewife's hands during dusting, cleaning, washing, and painting chores. Called Purr-Mitts, the soft pliable mittens are also useful when eating fried chicken or barbecue, in handling and washing delicate nylons, and for night hand-cream care. Produced by Central States Paper and Bag Co., 5221 Natural Bridge Ave., St. Louis, Mo.



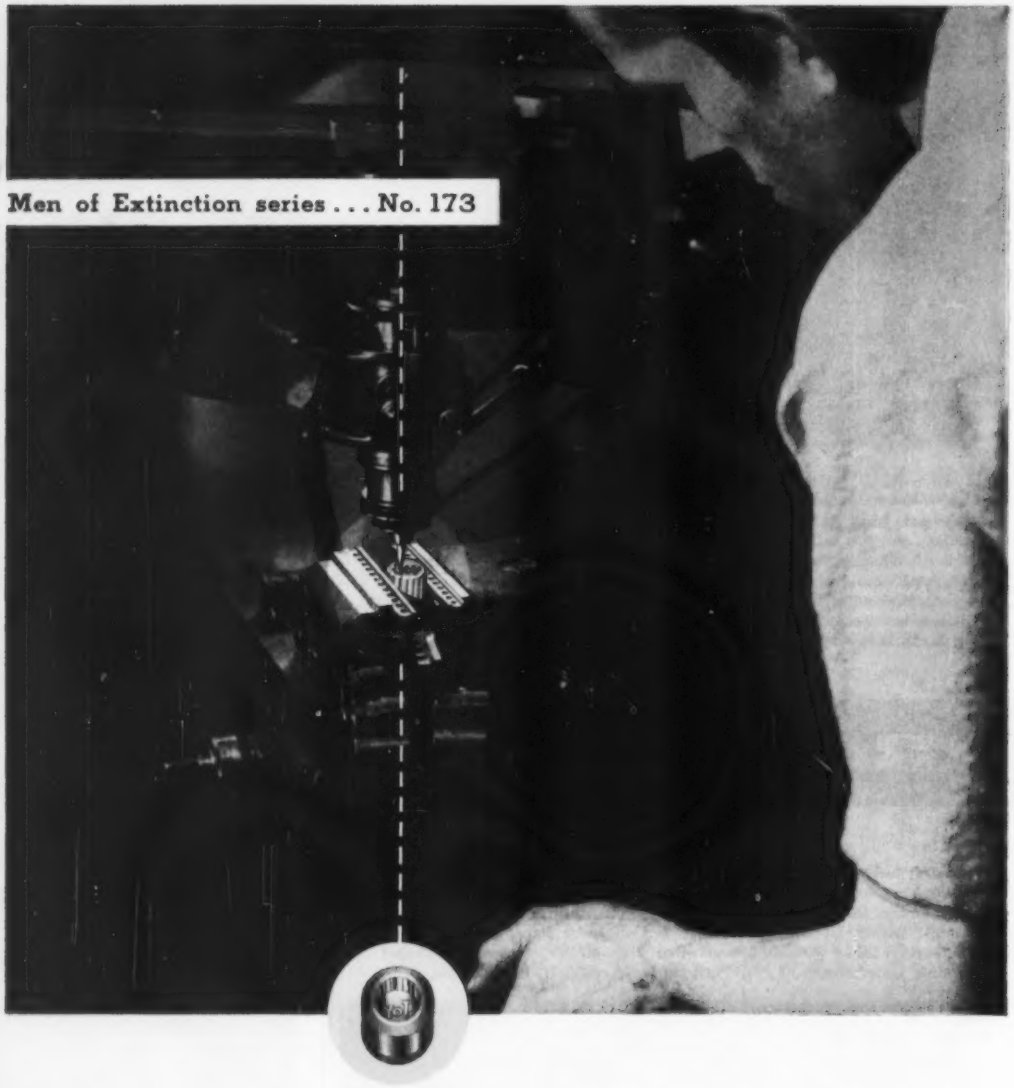
Mechanical toy bulldozer, molded of durable styrene in assorted color combinations, is an authentic version of the full-size model. To add to the realism, the toy is equipped with rotating caterpillar treads fabricated of tough, flexible vinyl, a detachable figure of a farmer in the driver's seat, and simulated tractor engine, clutch, and steering gear. The bulldozer, which moves in a forward and then a backward direction with one windup, is rugged enough to push heavy objects with its removable scooping blade. It is made by Ideal Toy Corp., 200 Fifth Ave., New York, N. Y.

Buoyant beach board, with tough, smooth outer skin and sponge-like interior, is molded in one piece of Marvinol vinyl. The 22-in. board, which can support up to 150 lb. in water, will not break in normal use and is unaffected by sunlight or weathering. It is made by Sponge Rubber Products Co., Shelton, Conn.

PRODUCTS

Virtually unbreakable handles, molded in ivory of Hercocel A cellulose acetate, are attractive and practical additions to a new set of kitchen knives. The handles, into which the blades are electronically sealed, are resistant to most kitchen fats and greases and can safely be placed in the modern home dishwasher without distortion or discoloration. Molded by Laurel Plastics, Lakewood, N. J., for Washington Forge, Inc., Englishtown, N. J.

Light switch plate, molded of Tenite I cellulose acetate in the form of a mermaid, lends a novel touch to the bathroom. A flick of the mermaid's tail turns the lights on or off. Plate is made by Falcon Plastic Products Mfg. Co., 6020 West Washington Blvd., Culver City, Calif.



Nickodemus is one of a number of capable people whom we meet when prowling around the premises at MD&E. It is people like Nick who have a hand in making Hobbed Cavities by Midland. He qualifies as a man of extinction because he wants to monkey around triple-checking, thousandths, tens of thousandths, angles, contours, depths, etc. We're busy, and don't have time, but Nickodemus insists. We can't let him go because he owns the micrometer. Such is the situation at MD&E. Wherever sophisticated molders gather, the name Midland comes up when Hobbed Cavities are mentioned. Midland Hobbed Cavities, as you know, are proving every day that two things *are* alike . . . even 16 things . . . even 32 things, plastics units that is. If molding big or small plastics units in uniform multiple quantities, is your business, write Midland Die & Engraving Co., 1800 W. Berenice Ave., Chicago 13. Midland also makes plastics molds, die-cast molds, engraved dies, steel stamps, pantograph engravings.

PLASTICS ENGINEERING*

F. B. Stanley, Engineering Editor

Slush Molding Molds and Techniques

How molds are made and used in versatile production method of molding varied products from vinyl plastisol

by Eugene B. Greenspun†

SLUSH molding of vinyl plastisols offers many advantages. By this process, molded articles can be produced in small or large quantities, as desired, with minimum mold cost and maximum process flexibility. Molds can be made rapidly and, if the product as originally designed does not meet market demands, changes can be made quickly and new molds put into production with little loss of time. A well-designed slush-molding production line is so adaptable to change that new molds can be put into service without interfering appreciably with production in other molds on the same line.

But slush molding is no cure-all, no panacea for molding problems. It has its draw-backs, its pitfalls, its limitations. Seven years of experience in the slush-molding business have given the writer a wealth of knowledge that will be passed along in this article. In those seven years has been produced an array of products that would take pages to enumerate. But the scope and possibilities of the slush-molding process can be indicated by listing a few of the items which have been successfully molded in that period of time. This list embraces shoe soles; boots and rubbers; puppets; manikin hands; rattles; doll heads, arms and bodies; false faces; gas masks; glass coasters; paint and tooth paste tubes; falsies; bottle warmers; toy baseball gloves, baby booties, and football helmets; faces for plush toys; vinyl pocketbooks; fishing lures; bottle holders; and flexible bottles.

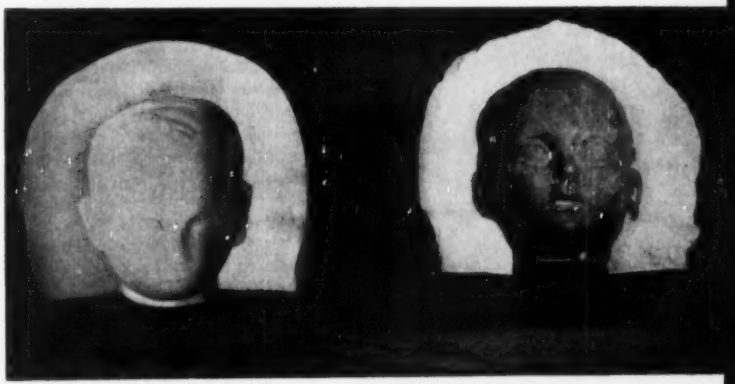
In compression and injection molding, cost of molds and time of mold production are important factors. In slush molding, on the other hand, working molds can be produced by electro-deposition of copper in three to seven days, depending on size, at a cost of from 10 to 25 dollars for the original mold. For small objects, the wall thickness of the slush molding mold should be about $\frac{3}{32}$ in.; for large objects, where the mold has little support, a wall thickness of approximately $\frac{1}{8}$ in. is desirable.

Wax Casting

Slush molded items can be produced in the soft vinyls only; the process is not adaptable to the hard types. But since the production process is relatively simple, it offers a multitude of opportunities to explore new markets with a minimum of expense.

First step in production of a slush mold is either a model or a drawing of the item. If a drawing is supplied by the customer, it is rendered into a model of plastoline. In either event, the finished model is used to produce a sectional plaster of paris mold. After the plaster is dry, the model is removed and wax is cast into the plaster mold. The wax is a formulation of paraffin and carnuba, in ratios depending upon the artist's taste for finishing hard or soft wax. The starting formula is 50% paraffin and 50% carnuba. More paraffin and less carnuba results in a softer wax, and vice versa.

Just prior to pouring the molten wax into the plaster mold, the sur-



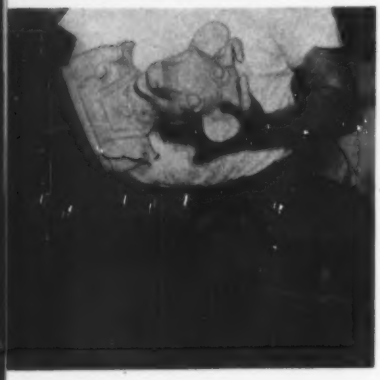
All photos with this article courtesy Bakelite Co.

Model of a part to be produced by slush molding is used to produce a sectional plaster of paris mold. Original model is still in place in the plaster mold half at the right

* Reg. U. S. Pat. Off.
† President, Geneve Mfg. Corp., Trenton, N.J.

Wax casting from plaster mold is given finish by master sculptor

Sensitized wax casting with conductive wire attached is placed in plating bath



A plated mold, from which the wax casting will be removed by melting out

face of the plaster is thoroughly dampened. If this precaution is not observed, the wax casting will be very rough.

It is desirable that the wax compound have a low melting point—about 250° F. If the melting temperature is too high, the plaster mold will steam, resulting in pinholes which require hours to remove.

When a satisfactory wax casting is removed from the plaster mold, it is smoothed and polished and is then ready for the steps leading up to the production of the final slush casting copper mold. It should be noted here that plastic pieces from finished molds can also be used to produce additional molds and thus step up the speed of the slush molding process.

Preliminary Steps

The wax pattern or plastic part is first cleaned with methyl ethyl ketone to remove all traces of grease. Then a copper wire is attached to a non-critical area of the part to be plated. This will serve later as a conductor for the plating current.

Three preliminary steps are necessary before starting to build up the copper mold. First, the pattern is immersed in a solution of 10% stannous chloride and 2% hydrochloric acid, which cleans the surface and provides a good acid base for sensitizing. Then it is removed and sprayed with a sensitizing solution of 225 g. of silver nitrate and 225 cc. of ammonium hydroxide in 2 gal. of water. After this sensitizing operation, the pattern is dryed and then sprayed with a solution of 245 cc. of 45% formaldehyde in 1 gal. of water to prevent oxidation of the silver nitrate.

The final copper-plating process, which produces the finished mold, takes from three to seven days, depending upon the size of the mold, the plating process, and the thickness of the mold.

Formulation of the standard acid copper-plating bath is as follows: Water, 1 gal.; copper sulfate crystals, 27 oz.; sulfuric acid, 6½ ounces. Temperature of the bath during plating should be approximately 75° F. Current density may range from 8 to 40 amp. per sq. ft. of plating area. The plating solution is poured into a ceramic vessel with large copper electrodes on each side. The object to be plated is suspended by its copper conductor in the center of the vessel, in which provision is made for clean compressed air to constantly agitate the plating solution. A rheostat is used to adjust the amperage of the plating current, with due regard to the size of the bath as well as the size of the object on which the mold is to be electro-formed. Low amperage requires a longer build-up time but produces a mold having a fine and dense copper structure; too high an amperage results in a large crystalline structure and a tendency to burn the surface of the mold, preventing further copper adhesion. During build-up of the copper mold, the part is removed daily from the bath, washed in fresh water, and replaced in a different position in the bath. These precautions result in uniform plating over the entire object.

From this brief discussion of the method of producing slush molds, it can be seen why they are inexpensive. After the model is produced, the cost of electroforming involves only preparation, the plating bath, the plating current, and the daily washing and replacement in the bath.

Samples Molded

When electroforming of the mold has reached completion, the plated object is removed from the bath and the wax or plastic is melted out. After the interior of the mold has been thoroughly cleaned, several dozen samples are molded. From these it is possible to derive exact costs of raw material and labor; then an accurate quotation can be made without fear of overcharging the customer or incurring a loss.

Up to this point, the customer has made an investment of only about $50 for the original model and approximately $25 for the first mold. And already he has several dozen samples of his product. These samples can be molded with different wall thicknesses so that the customer can study this factor and the accompanying variations in material costs. In addition, he can start market surveys with the samples. Sometimes it is found that a product does not show promise. Then changes can be made, a new mold produced, and more samples molded—all within about two weeks time. If the product finds a ready market, five or ten or as many molded parts

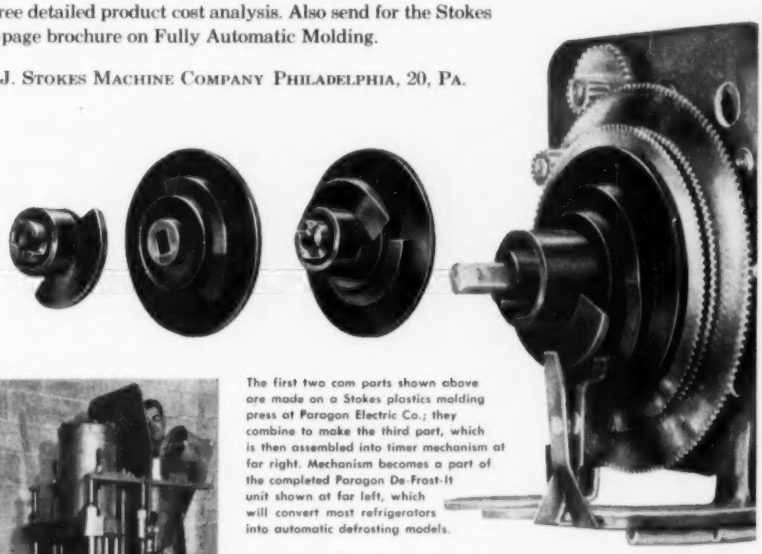
How One Manufacturer Saved 83% on Plastic Molded Parts

Cost per set of plastic timer cams was reduced from 6¢ to 1¢ . . . production per hour increased from 575 to 720 sets . . . savings boosted to $40,000 per year . . . when a Stokes fully automatic plastics molding press was installed at Paragon Electric Company, Two Rivers, Wisconsin.

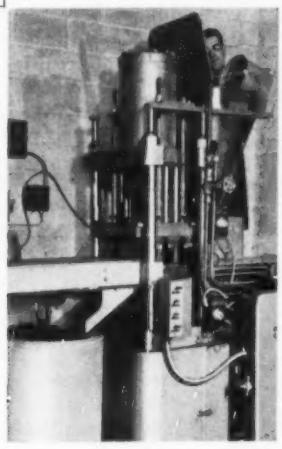
Paragon first produced an outlet assembly for the bottom of its De-Frost-It unit, an automatic refrigerator defroster, on its new Stokes Model 741, 50-ton press. Then came two plastic timer cams . . . intricate in design . . . requiring a knife-sharp edge at one point. All parts were produced with complete success . . . mold costs completely liquidated . . . labor cost reduced to the vanishing point.

Send your parts or blueprints to Stokes Advisory Service for report on their suitability to fully automatic molding, and a free detailed product cost analysis. Also send for the Stokes 24-page brochure on Fully Automatic Molding.

F. J. Stokes Machine Company Philadelphia, 20, Pa.



The first two cam parts shown above are made on a Stokes plastics molding press at Paragon Electric Co.; they combine to make the third part, which is then assembled into timer mechanism at far right. Mechanism becomes a part of the completed Paragon De-Frost-It unit shown at far left, which will convert most refrigerators into automatic defrosting models.



Operator fills the hopper of the Stokes Model 741 plastics molding press at Paragon Electric Co. This one operation, performed once every eight hours, is all the attention the press requires.

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Thermatron DIVISION

At the first station of a slush molding set-up, a mold is held under a special valve preparatory to filling for first time in the cycle

Compounded plastisol flows freely from the fast-acting valve into the mold beneath. Operator permits flow to continue until the mold is full

as desired can be used as models for producing additional electroformed molds. These will be the production molds, and it will take only three to seven days to have them on the line.

With ten molds in use, a production rate of 600 to 800 pieces per day may be expected, or between 3000 and 4000 pieces per week. This production can, of course, be increased up to the physical limitation of the slush molding equipment simply by making more electroformed molds from molded parts—and the speed-up can be accomplished within a week after the order is placed.

The slush molding process has a number of other advantages. Mold life seems to be almost indefinite; electroformed molds have been run continuously for as long as three years without showing signs of wear. The mold design can be such that there is no parting line; thus, the piece requires no finishing after it is removed from the mold. Decorating can be accomplished by hand painting or airbrush spraying.

Molding Operations

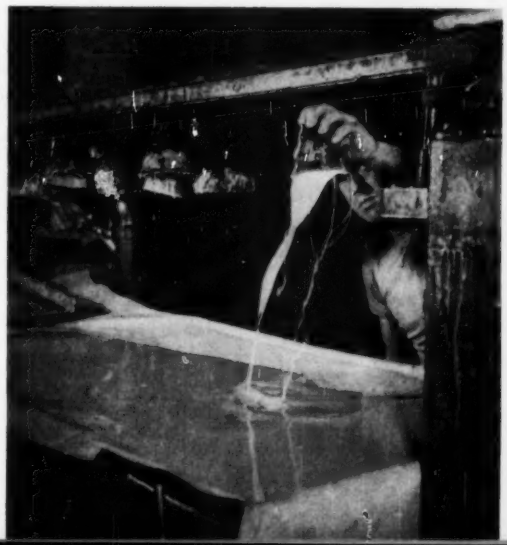
No two slush molders operate in exactly the same way. There are many tricks to successful operation which can be learned only through experience, the application of common sense, and intelligent thinking. However, a description of the methods used at Geneve Mfg. Corp. will serve as a guide to the design and operation of a basic slush molding set-up.

The slush molding process, reduced to the simplest terms, involves filling the mold with plastisol, dumping the material so that only a relatively thin film remains on the mold walls, curing that film, cooling, and removing the finished product.

In the Geneve plant, the molds are all handled on conveyors. There are basically three stations on each production line—initial filling and dumping, second filling and dumping, and removal of the molded item.

At the first station, the mold is filled from a reservoir of plastisol through a fast-acting valve or spout. A valve known as a gascock, made of brass and widely used in the gas

(*Continued on p.* 104)



After filling, the mold is inverted over a screened tank. Plastisol continues to drip from the molds after they are hooked onto the conveyor and started to first oven

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For more detailed information on Styron *475*, Styron *666*, or other Styron formulations such as Styron *777*, *637*, or *700*, write to THE DOW CHEMICAL COMPANY, Midland, Michigan, PL 1411.

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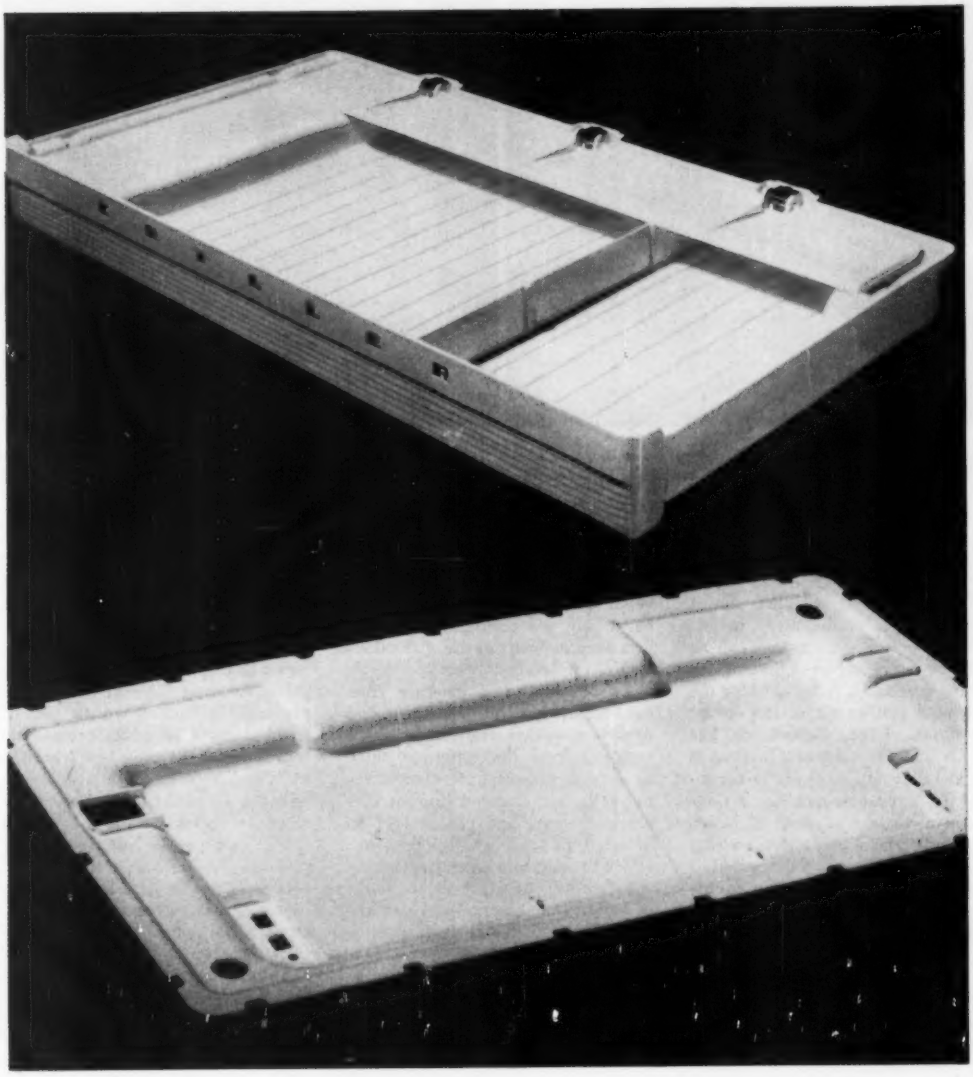

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As molds emerge from first oven and reach second station, they are removed from conveyor, refilled, redumped, and replaced on conveyor

From second oven, molds pass through a spray bath where they are cooled. An air blast dries mold and pieces before parts are removed

industry, will give a fast and positive pour.

After the mold is filled almost to the top, it is necessary to remove all entrapped air. This can be done by vibration or agitation, by pulling a vacuum, or by spinning the mold and getting rid of the air by centrifugal force. Experience has shown that the vibration method is the simplest and most easily adaptable to a custom-molding set-up where a variety of sizes of molds may be in production at one and the same time. The vacuum method is cumbersome because of the equipment required to handle both small and large objects as they come along; spinning is difficult with large objects and the expense of building spinning equipment for each new item can be prohibitive.

For these reasons, the vibration method is used in the Geneve plant. It admirably serves the purpose of removing entrapped air and can be as simple as shaking the mold by hand. At most, the equipment required is a small dental vibrator.

After the mold is filled and vibrated at the first station, it is hung upside down on the conveyor line. The excess plastisol drains into a screened tank; the small amount that remains on the mold wall gels as the mold is carried by the conveyor into the first oven. As will be shown, the temperature of this first oven determines the wall thickness of the finished piece.

As the hot mold emerges from the first oven, it reaches the second operation station. Here the mold is removed from the conveyor, filled again with plastisol, vibrated to remove the air, dumped into another screened tank, and replaced in an inverted position on the conveyor which takes it to a second oven.

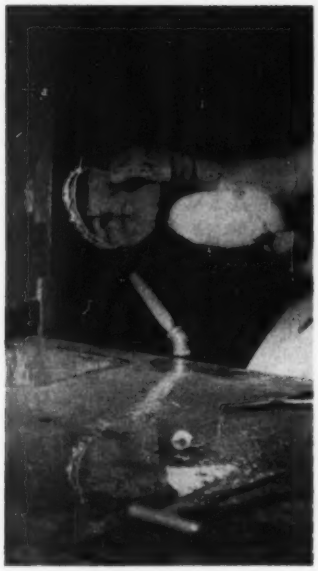
The key to final wall thickness is found in the temperature of the first oven. If that temperature is high, the mold will reach the second station while very hot. Then the plastisol charged into the mold at the second station will gel rapidly and, when the mold is dumped, a heavy wall of material will remain in the mold. Conversely, a lower temperature in the first oven will result in a cooler mold, less gelling of the plastisol at the second station, and hence a thinner wall section in the molded part.

From the second station, the conveyor takes the mold through a second oven, where cure is completed. As the mold emerges from this oven, it passes through a water chamber where a simple arrangement of shower heads sprays cooling water on the outside of the mold. From the water chamber, the mold is conveyed to the third station where the plastic bead on the edge of the copper mold is broken with a pair of small pliers. A jet of compressed air serves to release the piece from the mold and the piece is removed, again with the aid of the pliers. The empty mold is then returned to the starting point by a conveyor and is ready to begin the cycle once more.

One set-up such as has just been described will accommodate approximately 200 molds and will have a total time cycle for each piece of about 15 minutes. Thus the 200 molds go through the machine four times in an hour, producing 800 pieces in that period, regardless of whether the items weigh one or ten oz. each.

In fact, the only restriction on this production rate is that, if many of the molds are large, the number of molds must necessarily be less than the maximum of 200 because of space limitations, and production will be cut accordingly.

A big advantage of this arrangement is that the 200 molds on the



Parts are removed from the mold by hand with the aid of a jet of air

conveyor need not be all of the same size or shape; actually, 200 different products could be run on the line at the same time, so long as they can all be molded in the same color or material. Another advantage is that if a customer cancels or changes an order, molds can be removed or replaced on the line with no lost time and no set-up charge. The flexibility in scheduling work is obvious.

Materials

It is not possible to place too much emphasis on the importance of the quality of the plastisol material used in slush molding. Seven years of experience have revealed many pitfalls. These ranged from water in the plastisol which resulted in innumerable air bubbles that could not be conveniently removed to incorrect formulations which produced pieces that rapidly changed from a flesh color to an undesirable brown or from a solid to a spotted color.

Rigid specifications must be set up for material formulation. Cheap plastisols or materials incorporating cheap plasticizers cannot be used without the probability of getting into trouble. Only the finest ingredients can safely be used in plastisols for slush molding. The cost will be higher, but only by demanding the best can there be assurance that the molded parts will have permanent color and permanent texture.

When slush-molded products are to be decorated, the paint must be chosen with equal care. Good vinyl lacquers are so formulated that, when properly sprayed, the resulting color cannot be rubbed off no matter how much friction is applied. This is accomplished by the use of biting solvents which penetrate into the cured plastic surface and carry the pigments with them.

Spraying of vinyl plastisol pieces must be done at a 90 degree angle to the surface. Optimum air pressure is approximately 40 lb., and the paint solution should be as thin as possible. The thinner the paint, the more it will bite into the vinyl. If a faint color is the ultimate aim, the only way it can be successfully achieved is by thinning down the color not only with a standard thinner but also by the addition of a clear vinyl lacquer as a carrying agent. Methyl ethyl ketone as a solvent will speed up drying time; cyclohexanone will slow down the drying time so that the color has a longer time to penetrate the surface.

It's Exciting

That, briefly, is the whole story of the production of slush molding molds, the method of using them, and the decoration of the molded pieces. Turning out some 6000 pieces in an 8-hr. day, using 200 molds costing only about $2000 total and having an almost limitless life, is an intriguing business. It is even more intriguing to see 20 or 30 or more different molds running on the same machine at the same time. It's exciting work. The very versatility of the process continually opens new avenues of approach to new applications of one of the newest and most promising plastics.

Left: Masks are used in many painting operations on slush molded parts

Below: Skilled operators must apply certain decorative details by hand

Courtesy Captain Video Television Productions

Toy space helmet was designed for television show, is also being used as a premium item. Parts are formed from thermoplastic sheet by automatic process described below

Automatic Sheet Forming

Details of equipment and process in which thermoplastic material is indexed from supply roll through heater to forming die and to final snap-out stage

TRAVEL in outer space is very much in the public eye through the media of TV, comics, and science fiction. As emphasized in the article starting on p. 91 of this issue, the natural result has been the production of a variety of space toys in general and space helmets in particular.

The "Captain Video" space helmet mentioned in the above article is being produced with equipment and manufacturing techniques which merit more complete examination from the engineering standpoint. This helmet consists of five parts—four formed and one die-cut—all made of cellulose acetate sheet furnished by Joseph Davis Plastics Co., Arlington, N.J., and Eastman Kodak Co., Rochester, N.Y.

Three of the formed parts—the helmet and the two simulated earphones—are formed from colored stock; the fourth—the facepiece—is formed of transparent material; the neckpiece is die cut to shape from colored sheet. The simulated earphones are glued in place on the neckpiece; dot fasteners hold the other parts together and also permit the facepiece to be pulled over or away from the wearer's face.

Pressure and Vacuum

The forming techniques make use of air pressure to force the heat-softened sheet into a female die and vacuum to remove residual air from the space between the sheet and the die. If vacuum were not used, it would be practically impossible to force the sheet uniformly into contact with the female die.

The methods of production have been so refined that these forming jobs are now being run on a fully automatic basis. A roll of sheet stock feeds the production line; an operator snaps the formed pieces, which have been previously scored, from the web at the last stage.

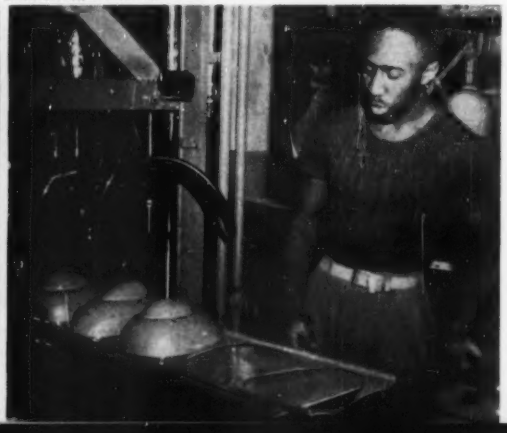
The manufacturer of these parts, Plaxall Inc., Long Island City, N.Y., is operating under a license arrangement from Design Center Inc., Long Island City, N.Y., owners of patents on the machinery and the forming process.

The particular space helmet under discussion was designed by

Sheet is automatically indexed over heater in foreground, then under forming mold. Mold is closed and clamped by means of air cylinders

Ejection side of sheet forming press. Parting line of the formed pieces has been deeply scored so that they can be snapped from the web

Production photos with this article courtesy Plaxall Inc.



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Monowatt units with BEETLE housings have been in use for over two years *without a single reported failure due to arcing.*

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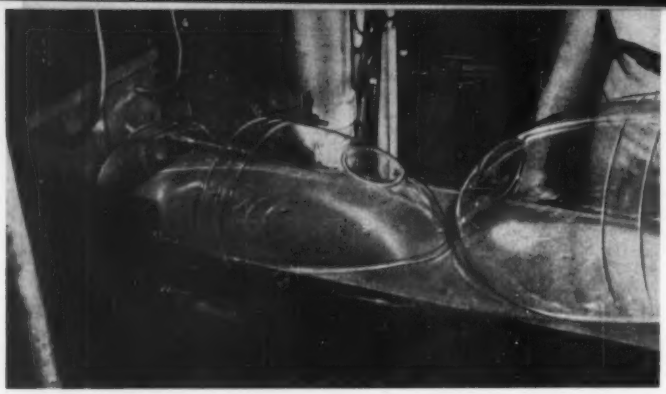
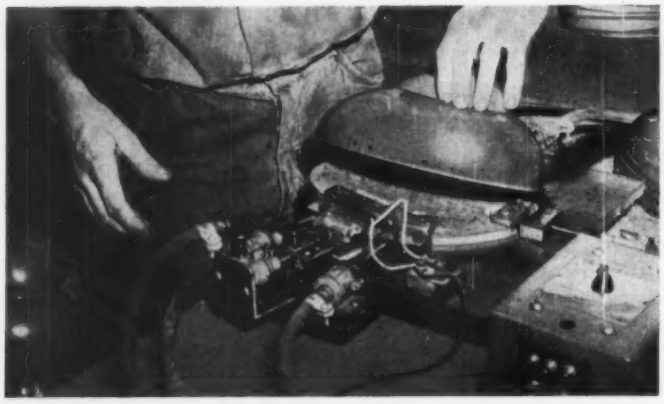


Two facepieces are formed at one time in special two-cavity mold. In this case, the division line between the two pieces, as well as the parting line, has been deeply scored



Six holes are punched in the headpiece (three in each side) by means of an air powered punching fixture; four are for the neckpiece and the other two are for the facepiece

Dot fasteners are assembled in the six holes previously punched in the headpiece, using an automatic punch press. The facepiece pivots on one pair of the fasteners

Louis H. Pfohl, president of Design Center Inc., for use on the Captain Video television program. It is also being used as a premium item by General Foods Post Cereals Div. to promote their Cornfetti and Raisin Bran.

It is a one dollar premium item and, according to General Foods, is one of the most successful promotions which have been developed in that price range to date.

Forming Procedure

The molding operation proceeds along the following general lines: Acetate sheet stock is fed from a roll by chain conveyor through all the forming operations. A section of predetermined length is first drawn over an electrical heater where it is permitted to remain for approximately 10 seconds. The heater is so constructed that it will heat the exact area of sheet required for the part or parts about to be formed. The heated sheet is then fed under a forming die mounted under the head of a downward operating air-operated forming press.

On the bed of the press is a clamping ring so designed that when the female die is lowered on top of the sheet the edges of the sheet are clamped air-tight between the die and ring. A port in the center of the bed of the press is connected through electrically operated air valves to a source of compressed air. The female mold is designed with small ports or openings which in turn are connected through other electrically activated valves to a source of vacuum.

After the heated sheet has been indexed in its proper position on top of the clamping ring and beneath the female die, a valve is automatically opened to admit air pressure to air cylinders which raise and lower the female die. After the die is clamped against the sheet, air pressure is admitted under the sheet, forcing the softened sheet upward into the die. At the same time, air is evacuated from the die so that the sheet will be pressed uniformly against the die.

The actual forming operation is completed in a fraction of a second, but aproximately 8 to 10 sec. are required for the formed sheet

to cool and become rigid. The die itself, of course, is cored for circulation of a cooling medium to expedite cooling of the sheet stock. At the end of the cooling period, the die opens and the conveyor chains index forward, carrying the formed piece out from under the die and replacing them with a heated section of sheet stock. Then the die closes and the forming cycle is repeated.

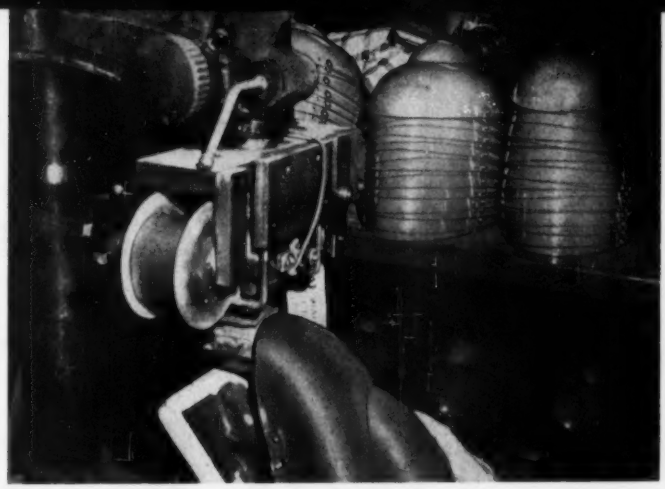
Material Scored

An interesting feature of this process which aids greatly in making it fully automatic is that, as the cooling cycle approaches its completion, a cutting edge engineered to the exact shape of the parting line of the finished piece is forced downward against the sheet stock. This scores the material around the periphery of the parting line so that the formed pieces can be simply snapped out from the web. No further finishing or trimming is required.

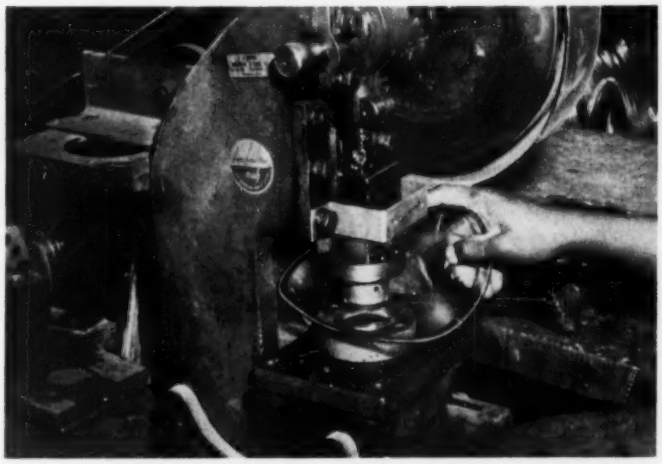
In the case of the transparent facepiece of the space helmet, a two-cavity die is used; for the opaque colored helmet section, two parts are formed at the same time; a six-cavity die is used for the simulated earphones. The sheet used for the helmet and facepiece is 0.022 in. stock; that for the earphones is 0.015 in. stock. The helmet is drawn to a depth of 4 in. and the 0.022 in. stock draws down to approximately 0.015 in. at its thinnest point.

Recommended temperature of the sheet as it is drawn under the die is from 220 to 250° F. The female mold is held at a temperature of 130° F. by the thermostatically controlled circulating coolant.

While this article is concerned primarily with the forming of the parts for the space helmet, there are numerous other objects now being manufactured by Plaxall Inc., on the same equipment. Among these are formed packages of which one is being produced at the rate of 125,000 per day, formed lighting fixtures, and displays of all kinds. Arrangements are being made whereby Design Center Inc., will expand the manufacture and rental of this equipment, and it is expected that this will greatly widen the use of thermoplastic sheet material.



A final decorative touch is added to the futuristic space helmet (see also photo on p. 106) by gold stamping an emblem on the front of the colored sheet-formed headpiece



An automatic punch press and a special die are used to cut a hole in the facepiece of the space helmet so that the youngster can breathe freely and eat while wearing it

Simulated ear phones, formed in a multi-cavity mold, are glued in position on the die-cut neckpiece. A jig is used to position the pieces in their correct location

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PLASTICS*
TECHNICAL SECTION: Dr. Gordon M. Kline, Technical Editor

Effects of Atomic Radiation on Polymers

by Leo A. Wall† and M. Magat††

The effects on solid polymers of exposure to atomic pile radiation and the degradation of solutions by exposure to γ-rays from radium have been studied by the use of viscosity methods. In the former case variation of the structure of the polymer has been shown to cause both increases and decreases of molecular weight. It has also been demonstrated that, depending on the type of polymer, the measured intrinsic viscosity can be varied by the use of inhibitor-containing solvents in carrying out the measurement. This is taken to be evidence for immobilized free radicals within the solid polymer after exposure.**

When solutions of polymers were exposed to γ-rays, oxygen was found to be necessary for degradation. In this case an aftereffect has been observed which is eliminated by the presence of inhibitor during the period of irradiation. The degradation appears to be a function of the square root of the number of radicals produced from the effects of γ-rays on the solvents used.

DURING the past five years considerable work has been published on polymerization induced by neutrons and γ-radiation (1).[1] The decomposition of polymers by heat, light, and chemical action has been for many years an important field of investigation (2). The subject of the present study is concerned with the effects of neutrons from atomic pile radiation and γ-rays from radium on the structure of polymers. An important advantage in studying polymer decomposition induced by neutrons is the possibility of producing selective points of initial radical formation through the substitution of atoms such as bromine and chlorine, which have a greater capture cross-section for neutrons than carbon or hydrogen. Therefore, comparison of the degradation of polystyrene with that of copolymers of styrene with vinyl bromide and *p*-bromostyrene should afford information about the mechanism of the reaction.

In the case of pile radiation, background gamma rays may augment the difficulties in interpreting the results. Gamma rays themselves, by acting on the extranuclear electrons, produce a variety of chemical effects, presumably due to the formation of free radicals (1) which would also preferentially attack bromine atoms.

Materials

Two samples of fractionated polystyrene, one of M.W. 600,000, the other of M.W. 117,000, were obtained from the Dow Chemical Co., and commercial samples of polymethyl methacrylate and polyvinyl chloride were used without further purification. Four copolymers were prepared from mixtures of styrene—vinyl bromide, 9:1; styrene—*p*-bromostyrene, 9:1; methyl methacrylate—vinyl bromide, 9:0.7; and methyl methacrylate—*p*-bromostyrene, 9:1. The polymerizations were carried to apparent completion and then the polymers were precipitated twice with methanol from benzene. The third benzene solutions of the polymers were frozen and the solvent was removed by sublimation. Finally the polymers were kept in a vacuum at 80° C. with continuous pumping for several days to remove as much of the remaining traces of volatile materials as possible. From bromine analyses on the copolymers the mole percent of the bromine-containing monomer was computed. The results were: styrene—vinyl bromide copolymer, 0.9%; styrene—*p*-bromostyrene, 9.8%; methyl methacrylate—vinyl bromide, 0.05% and methyl methacrylate—*p*-bromostyrene, 7.0%. All polymers were in the form of a coarse powder.

Experimental Procedures

During irradiation in the pile at Chatillon, France, the powdered polymers were sealed in small boron-free glass ampules without evacuation.

After the return of the samples from the pile they were stored about one week to allow the short-lived activity to decay. They were then dissolved in appropriate solvents and their intrinsic viscosities determined. The intrinsic viscosities of non-irradiated samples of the same polymers were also determined. An Ubbelohde-type viscosimeter with an

* Reg. U. S. Pat. Off.
** This work was carried out at the Laboratoire de Chimie Physique, Paris, with the aid of a Fulbright Grant, 1951-1952.
† Polymer Structure Section, National Bureau of Standards.
†† Laboratoire de Chimie Physique, Paris, France.
[1] Numbers in parentheses link to references at end of article.

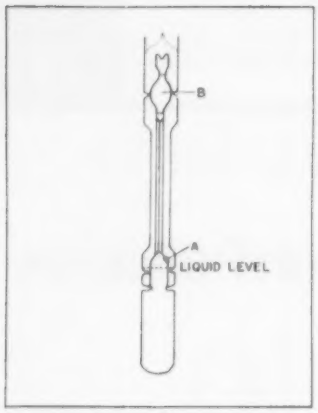

Fig. 1—Ubbelohde-type viscosimeter has opening A to assure flow time independent from volume of liquid, bulb B to collect solution

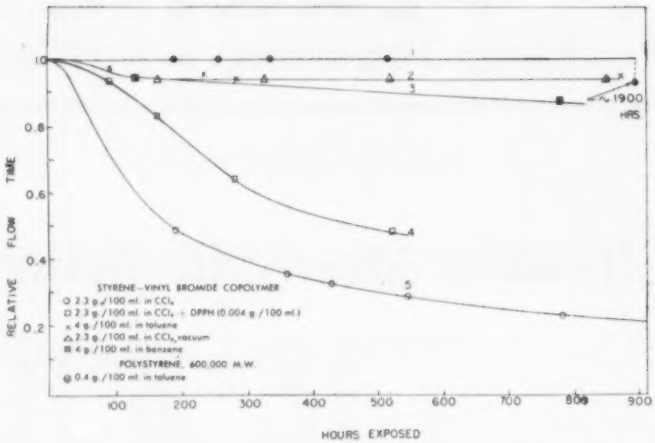

Fig. 2—Viscosity effects of gamma-ray irradiation on polymers in various solvents

enlarged reservoir, allowing dilution *in situ*, was used.

For the γ-ray irradiation only solutions of polymers were used and these were exposed while in tubes that were essentially Ubbelohde viscosimeters (Fig. 1). The dimensions of the tubes were approximately 240 mm. length, 22 mm. largest diameter, and 14 mm. small diameter. The volume of solution used in each tube was 25 ml. The polymer solutions filled the tubes to the level indicated. An opening (indicated by A) between the inner tube and outer tube is necessary for the flow time to be independent of the volume of liquid in the viscosimeter. The flow times were taken after inverting the viscosimeter for a short time to allow bulb B to fill. For some experiments the tubes were evacuated, degassed, and sealed off as indicated by the dotted line at the top of the figure. However, in the majority of the experiments the tubes were simply corked without removing the air.

Atomic Pile Irradiation

The studies with γ-rays were done at two different intensities, with a 275-millicurie radium source providing the γ-radiation. The data in Fig. 2 were obtained at a distance of 4.5 cm. from the source; those in Fig. 3 at 2 cm. from the source. The average intensities were 80.5 r./hr. and 243 r./hr, respectively. All experiments on the influence of γ-rays on polymer solutions were carried out at room temperature, approximately 20° C.

In the degradation of polymers it is usually very difficult to distinguish those processes that produce cross-linking from those that break the molecular chains. Only the overall results can in most cases be observed; i.e., an increase or decrease in properties depending on molecular weight. It was hoped that some information on this point might be obtained by exposing to neutrons copolymers made from styrene or methyl methacrylate with vinyl bromide or p-bromostyrene. The vinyl bromide unit should facilitate scission, the p-bromostyrene unit cross-linking. The general concept is that 1) the bromine atoms will preferentially capture neutrons, 2) the subsequent high energy recoil upon the emission of gamma rays from the bromine should break the C-Br bond, and 3) in the case of vinyl bromide copolymers, there is

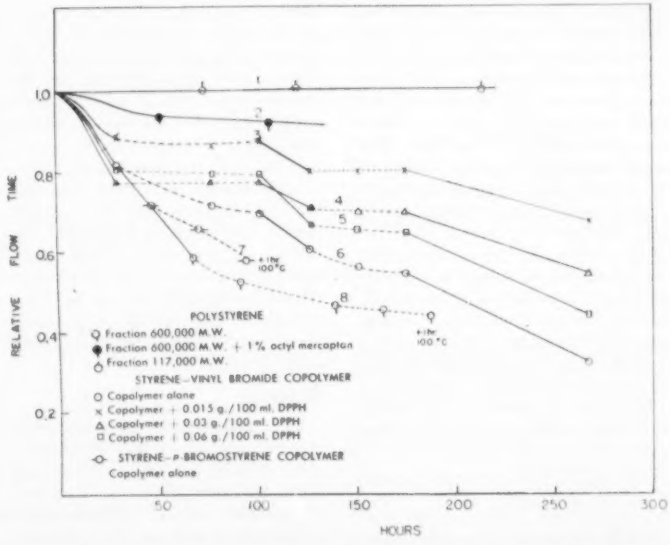

Fig. 3—Effect of γ-rays on CCl_4 solutions containing 4 g. polymer/100 milliliters

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Table I—Effects of Atomic Pile Radiation on Solid Polymers[a]

Polymer	Intrinsic Viscosity Before	After	After/Before	Solvent
Styrene[b]	1.16	1.08	0.931	Benzene
Styrene	2.60	2.42	0.931	Benzene
Methyl methacrylate	1.25	0.80	0.640	Benzene
Vinyl chloride	1.16	0.98	0.845	Tetranydrofuran
Styrene—vinyl bromide	2.25	2.05	0.911	Toluene
Styrene—p-bromostyrene	2.30	2.60	1.130	Toluene
Methyl methacrylate—vinyl bromide	0.40	0.40	1.000	Toluene
Methyl methacrylate—p-bromostyrene	3.36	2.34	0.696	Toluene

[a] Approximate conditions: irradiated 400 hr.; temperature 35°C.; intensity 2 x 10^{11} neutrons/hr./cm.^{2}
[b] Data of Lander, private communication.

very likely enough energy to break the nearby C-C bonds of the polymer chain. In the p-bromostyrene copolymers the stable phenyl ring between the bromine and the polymer chain should protect the bonds in the chains, and since the temperature is low (35° C. in the pile), coupling reaction would be favored, producing cross-linking. Bromine atoms are also more easily abstracted by free radicals than chlorine or hydrogen and hence the same sites should be preferentially attacked by free radicals whether produced by gamma rays or by the decomposition of peroxides or azonitriles. In the latter case the free radicals have only thermal energy and are not capable of inducing breaks in nearby bonds, while in the former situation excited free radicals are probably produced and should have a greater effect.

Table I summarizes the results of polymers irradiated in the atomic pile as solids. Polystyrene shows only a small decrease in intrinsic viscosity; the percentage decrease is the same for two materials of quite different initial molecular weights. It is seen that in the case of styrene copolymers, the one containing p-bromostyrene does show a small increase in intrinsic viscosity, whereas the vinyl bromide copolymer shows a decrease slightly greater than that of the polystyrenes. The behavior of these copolymers suggests that the molecular weight of polystyrenes subjected to ionizing radiation could be controlled by adjusting the amount and type of comonomer.

Polymethyl methacrylate exhibits the greatest decrease in molecular weight, which is probably due mainly to the sensitivity of the oxygen in the monomer units to the γ-radiation. The thermal stability of the polymethyl methacrylate is less than that of polystyrene and hence the greater degradation of the former material upon irradiation might also be expected. The p-bromostyrene structure appears to counteract the polymethyl methacrylate degradation to some extent, but the cross-linking effect from the action of neutrons on the bromine derivative appears to be overshadowed by the greater degradation due to the γ-rays on the methyl methacrylate units. It should be mentioned that aromatics are relatively stable to gamma rays (3) and hence polystyrene should be less affected by background radiation than polymethyl methacrylate. The viscosity of the vinyl bromide—methyl methacrylate copolymer, which was very low initially, was not noticeably changed.

Polyvinyl chloride showed only a small decrease in viscosity considering the fact that the capture cross section of chlorine for neutrons is an order of magnitude greater than that for bromine and the concentration of chlorine is greater by at least a factor of ten.

From these preliminary results it is concluded that the breaking of polymer chains occurs during exposure to neutron flux; the results also indicate that certain structures can be incorporated in the polymer to favor cross-linking, and possibly to stabilize plastics against the effects of neutron radiation.

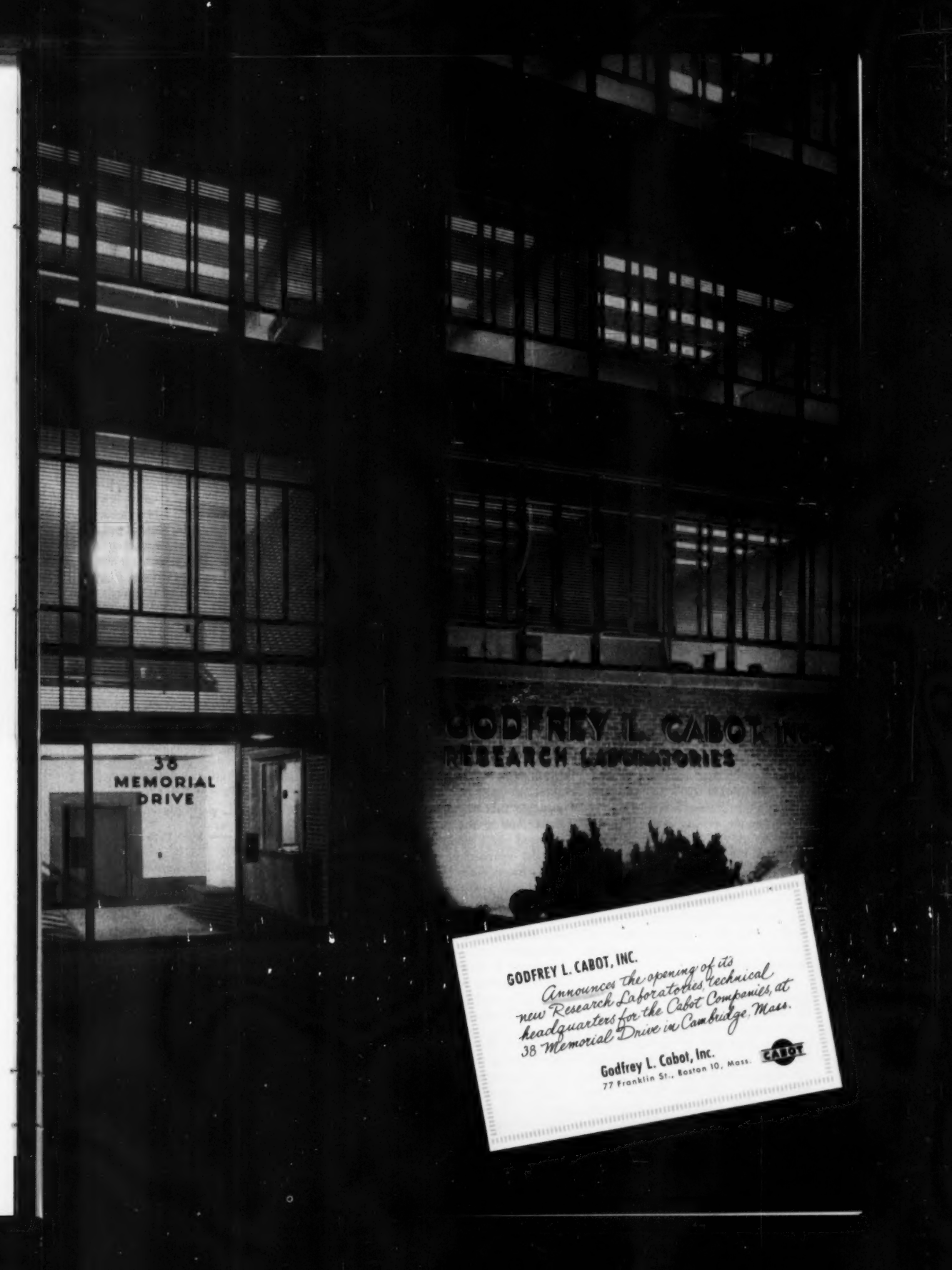
In Table II are presented the intrinsic viscosities of polystyrene and polymethyl methacrylate irradiated in the pile as solids and dissolved in various types of solvent for the viscosity measurement. If during irradiation a polymer molecule is broken into two free radical species which are unable to terminate due to lack of mobility in the solid phase, and if on solution they would normally terminate by coupling, then on solution in an inhibitor-containing solvent the measured intrinsic viscosity should be lower than that obtained in an inhibitor-free solvent. A definite effect was obtained with polymethyl methacrylate in benzene solutions containing approximately 0.1% *tert*-butyl catechol and phenyl-beta-naphthylamine, respectively. The use of ethyl mercaptan did not produce an effect, although transfer agents, if active at the temperature of solution, should in theory result in behavior similar to the inhibitors. An experiment in which pile-irradiated polyvinyl chloride was dissolved in tetrahydrofuran gave no changes in intrinsic viscosity when measured with and without diphenyl picryl hydrazyl (DPPH) added to the solvent as inhibitor. It is interesting to note that with those polymers that are most likely to terminate by disproportionation (polystyrene and polyvinyl chloride) little or no effect was produced.

Gamma Irradiation

The action of γ-rays, unlike that of neutrons, involves chiefly the electrons in the sheils outside the nuclei

Table II—Effect of Solvent on Intrinsic Viscosities of Polymers Irradiated in Atomic Pile

Solvent	Intrinsic Viscosity Polystyrene	Polymethyl-methacrylate
Before irradiation		
Benzene	2.60	1.25
After irradiation		
Benzene	2.42	0.80
Benzene, sodium treated	2.41	0.81
Benzene + *tert*-butyl catechol	2.36	0.70
Benzene + phenyl-beta-naphthyl-amine	—	0.765
Benzene + 1% ethyl mercaptan	2.41	0.80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of the atoms. During the absorption of γ-rays many atoms are ionized and excited. As a consequence of the high energies involved, the molecules composed of these atoms are ruptured and free radicals are formed. The number of free radicals formed in a large variety of solvents has been measured by both the amount of polymerization occurring in mixtures containing monomers and by the decolorization of diphenyl picryl hydrazyl (3). In the 2 to 4% polymer solutions used in the present work, the primary action of the γ-rays is on the solvent and hence the effect in carbon tetrachloride, which produces a relatively high number of free radicals, has been compared with the effect in toluene and benzene, in which the radical yield is low.

The experimental results with γ-rays are given in Figs. 2 and 3, in which the relative flow times, i.e., all values divided by the initial value, are plotted against time. The absolute flow times were initially of the order of 5 to 10 min., while the flow times of the pure solvent were approximately 10 seconds.

In the first γ-ray experiment a tube containing the styrene—vinyl bromide polymer in carbon tetrachloride was evacuated and after the degassing of the solution, sealed off. Carbon tetrachloride gives a comparatively large number of free radicals on exposure to γ-rays and, therefore, might be expected to favor degradation of the polymer. After an initial small decrease in flow time, no further change occurred in spite of an additional 1000 hr. exposure at the higher intensity following the measurement of the last pertinent point on curve 2, Fig. 2. A second sample of the same solution, exposed in the presence of air, showed a continuous rapid decrease in viscosity (curve 5). The initial decrease in the vacuum experiment is most readily explained as the result of residual oxygen not removed by the degassing procedure.

Apparently at the temperature of these studies (20° C.) no decrease in molecular weight occurs unless oxygen is present. All the polymers studied degraded in carbon tetrachloride solution in the presence of air, except the low molecular weight polystyrene (117,000 M.W.). The 600,000 M.W. polystyrene degraded rapidly (Fig. 3, curve 8). In toluene and at the lower intensity (Fig. 2, curve 1), no decrease in flow time occurred for 500 hr., but on continuing the exposure for an additional 1400 hr. at the higher intensity, a 5% decrease in viscosity occurred. The 117,000 M.W. polystyrene in carbon tetrachloride showed no change in viscosity when irradiated over 200 hr. at the higher intensity (Fig. 3, curve 1). The initial flow time, however, was very low, less than the lowest flow time recorded for the degraded 600,000 M.W. polystyrene.

An atmosphere of pure oxygen apparently does not speed up the degradation process. This was demonstrated as follows. Solutions of 600,000 M.W. polystyrene in carbon tetrachloride and in toluene were saturated with pure oxygen and their tubes closed quickly after flushing with oxygen. In the toluene solution no degradation occurred, while in carbon tetrachloride the rate of viscosity decrease was about the same as when an atmosphere of air is in the tubes. In these and other experiments an induction period of about 24 hr. was observed. The curves are therefore drawn to indicate a small induction period, which was observed whenever early measurements were taken.

Unlike peroxide-induced degradation (4) at higher temperatures, the decomposition in these experiments in carbon tetrachloride continued until the flow times were within a factor of about 8 of the pure solvent without indication of any limit; that is, until flow times comparable to that of the 117,000 M.W. polystyrene solution were obtained. It may be possible that degradation under the conditions of the present work can proceed until material of molecular weight comparable with the solvent is produced, since the process is presumably a γ-ray-induced oxidation, without a concomitant depolymerization due to the low temperature. At the temperature of 20° C. the depolymerization of radicals into monomer is energetically not possible and hence any pseudo-equilibrium (4) would not be expected.

With toluene as the solvent and air present, the styrene—vinyl bromide copolymer showed a small decrease in viscosity and then leveled off (Fig. 2, curve 2). With benzene a similar small decrease occurred which did not level off. (curve 3). The difference may be due to the easier oxidation of toluene itself than of benzene, or the toluene may be protecting the polymer by transfer processes. The results in toluene and benzene indicate that the small amount of bromine in the copolymers sensitized the decomposition of the polymer at least in hydrocarbon solvents. In carbon tetrachloride (Fig. 3, curves 6, 7, and 8) the degradation was about the same whether the polymer contained bromine or not.

Free Radical Mechanism

The relative behavior in the solvents is compatible with the relative yield of free radicals from the solvents under the action of γ-rays (3). If one compares in Fig. 2 the degradation in benzene solution (curve 3) to that in carbon tetrachloride (curve 5), it is seen that approximately 14% degradation occurs in 800 hr. in benzene and in 50 hr. in carbon tetrachloride, a ratio of 16. Since measurements (3) of the free radical production in the two solvents give a ratio of 72 by the DPPH method and a ratio of 200 by the analysis of the polymerization rates, it appears that the degradation is not linear with the number of free radicals produced from the solvent. The square roots of 72 and 200 are 8.5 and 14, which are close to the estimated value of 16, and hence a square root relationship may exist. The following scheme for the degradation would then appear to satisfy our observations:

$$S^* + P_i \xrightarrow{k_1} S + P^*_i$$

$$P^*_i \xrightarrow{k_2} P^*_{i-x} + P_x$$

$$P^*_j + P^*_l \xrightarrow{k_3} P_j + P_l \text{ or } P_{j+l}$$

where S^* is a radical derived by the action of γ-rays on the solvent and P_i is a polymer molecule composed of i monomer units. Then the rate of degradation or the rate of scission, neglecting termination by combination, would be:

$$\frac{d\,[\text{scission}]}{dt} = k_2 P^*_i = k_2 \left[\frac{k_1}{k_3}\right]^{\frac{1}{2}} S^{*\frac{1}{2}} P_i^{\frac{1}{2}}$$

on the basis of the usual stationary state assumption for P^*_i and where S^* plays the role of the initiator for degradation. One requirement necessary for the above mechanism to operate at the temperature of

(*Continued on page* 176)

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Alkaline Degradation of Polyacrylonitrile

by J. R. McCartney*

STUDIES of the degradation of polymers by heat and chemical reagents, in addition to aiding in defining use properties, are valuable in elucidating chemical structure and other molecular features of polymers, such as molecular weight distribution. In the course of research on polyacrylonitrile,[1] it was found that concentrations of base of the order 10^{-3} normal in dilute polyacrylonitrile solutions produced rapid reductions in the intrinsic viscosity to 5 to 10% of the original value. The purpose of this paper is to present 1) the results of a study of this reaction, believed to be unique with polyacrylonitrile, and 2) a method utilizing this reaction for qualitatively defining molecular weight distribution of polyacrylonitrile. This method is applicable to any polymer that can be degraded in a controlled manner.

A specific example of the reaction will illustrate its principal features. A 1% solution of polyacrylonitrile in dimethyl formamide was made 0.002 N in sodium hydroxide by addition, with rapid stirring, of 0.2 N aqueous sodium hydroxide. A bright yellow color developed immediately, which darkened to orange and, on standing overnight, to deep red-orange. Upon addition of acid (HCl, 0.004 N in the final mixture) the deep color disappeared, leaving only a bright yellow. The polymer was precipitated by pouring the solution into hot aqueous sodium chloride solution, and the intrinsic viscosity and number average molecular weight (by osmotic pressure) of the recovered polymer determined.

The results are summarized in Table I and the osmotic pressure data are shown in Fig. 1. The difference in slope of the two osmotic pressure curves indicates that some chemical modification of the polymer took place during degradation. The difference in molecular weight shows clearly, however, that a degradation in chain length and not chemical change is primarily responsible for the intrinsic viscosity change.

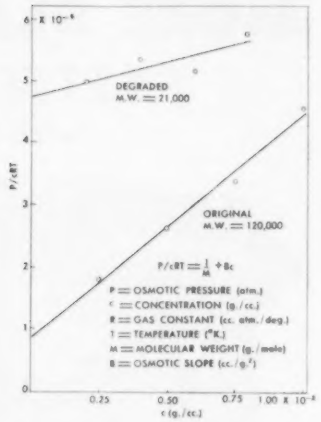

Fig. 1—Osmotic pressure measurements of caustic-degraded polyacrylonitrile

Effect of Solvent on Rate and Extent of Reaction

The degradation is extremely rapid in dimethyl formamide; both the rate and amount of degradation may be modified by addition of non-solvent. In one set of experiments four 100-cc. portions of 1% polymer in dimethyl formamide were made up and treated as follows:

(1) 2 cc. 1 N aqueous NaOH were added with rapid stirring, followed immediately by 5 cc. 1 N aqueous HCl, so that active base was present for only 1 to 2 seconds.

(2) 2 cc. 1 N aqueous NaOH were added with rapid stirring, and the solution allowed to stand 3 hr. before addition of 5 cc. 1 N aqueous HCl.

(3) 10 cc. dioxane were added. 2 cc. 1 N aqueous NaOH were then added with rapid stirring, followed immediately by 5 cc. 1 N aqueous HCl.

(4) 10 cc. dioxane were added. 2 cc. 1 N aqueous NaOH were then added with rapid stirring and the solution allowed to stand 3 hr. before addition of 5 cc. 1 N aqueous HCl.

Thus, two pairs of solutions were reacted, one pair containing dioxane. After addition of base, the reaction was stopped in one solution of each pair as quickly as possible by addition of acid and allowed to proceed for 3 hr. in the other.

All four solutions immediately developed a yellow color, although (3) and (4) were considerably lighter than (1) and (2); (2) and (4) darkened on standing. In 3 hr., (2) was deep orange-red and (4) was orange. Precipitates recovered by addition of the solutions to hot aqueous sodium chloride solution were colorless with the exception of that from (2), which was bright yellow. Solutions of concentration 0.2 g./100 cc. were made up, relative flow times measured, and intrinsic viscosities calculated (Table II).

The reaction was thus essentially complete in 1 to 2 sec. in dimethyl formamide, whereas addition of dioxane to dimethyl formamide re-

Table I—Alkaline Degradation of Polyacrylonitrile

Sample	*Intrinsic Viscosity*	*Molecular weight (number average)*	*Osmotic slope*
Untreated	3.3	120,000	3.6×10^{-3}
Alkali treated	1.5	19,000	1.1×10^{-3}

Table II—Effect of Solvent on Rate and Extent of Degradation of Polyacrylonitrile

Sample	*Intrinsic viscosity*
Untreated	3.3
1	0.3
2	0.3
3	2.05
4	1.65

*Technical Div., Textile Fibers Dept., E. I. du Pont de Nemours & Co., (Inc.)

[1] Houtz, R. C., Textile Research J. 20, 786-801 (1950).

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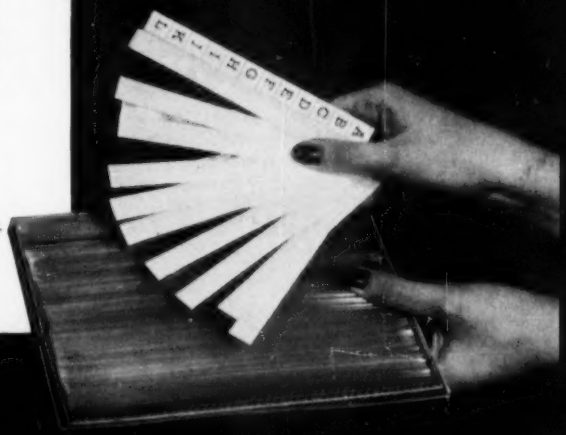

sulted in a decreased rate and over-all effect. The reaction of alkali with dimethyl formamide to form dimethylamine competes with the degradation reaction, so the decrease in over-all effect is probably a consequence of the decreased rate which permits the base to be partially neutralized by the solvent. In another experiment in which tetramethylene sulfone (which does not react with dilute alkali) was used as solvent, the rate of degradation was considerably decreased, but the over-all effect was the same as in dimethyl formamide solution. The importance of the competing reaction between solvent and base was emphasized by an experiment in which 1% polymer was dissolved in dimethyl formamide which had been made 0.05 N in sodium hydroxide just before the polymer was added. The base had been completely neutralized by the solvent during the interval required for the polymer to dissolve appreciably, as shown by the fact that no detectable degradation was produced.

Type of Degradation

As a step in clarifying the nature of the reaction, it was considered essential to establish as closely as possible the stoichiometric relation between the amount of caustic added and the extent of degradation produced. Two distinct possibilities exist for the formation of a degraded polymer: depolymerization by (a) splitting off monomer units ("unzipping"), or (b) random scission. Work of Jellinek[2] on polystyrene degradation has shown that when mechanism (a) prevails, the yield of monomer is 10^3 to 10^4 times that calculated from mechanism (b); so it is possible to distinguish between (a) and (b) by determining the percentage of degraded polymer recovered by precipitation from solution, presuming the monomer formed is lost in this recovery process. The following set of experiments was accordingly carried out:

To 500 cc. portions of 2% polymer in dimethyl formamide were added 20 cc. portions of aqueous NaOH of various normalities selected to cover a wide range of degradation. After standing overnight, each solution was divided into two equal parts; part B was acidified with 10 cc. of 2 N HCl, while part A was not acidified. The polymers were precipitated by pouring the solutions into hot aqueous NaCl, filtered, washed thoroughly with water, followed by acetone, dried *in vacuo* at 80° C., ground to a fine powder, and redried to constant weight. The recovery data are given in Table III.

There is no significant difference between recoveries of the caustic treated samples and the control. Although there is some scatter in the recoveries, there is no evident trend with amount of caustic added or no difference between A and B samples. The average number of grams recovered in the ten samples 2A to 6B is 4.50 ± 0.16, not significantly different from the control (4.47 ± 0.06). Losses of monomer approaching 100% of the original weight would be expected for the most highly degraded samples if an unzipping mechanism prevailed, so it may be concluded that the degradation proceeds by random chain scission. Further support for this conclusion is given by the observation that the extent of unzipping would be affected by the catalyst used in the polymerization. The extent of degradation has been independent of catalyst in all the polymers tested.

Nitrogen analyses of the recovered samples are included in Table III; essentially 100% of the nitrogen was retained by the degraded samples, with the exception of the most highly degraded (6A and 6B).

Stoichiometric Relation

It is characteristic of degradation reactions which proceed by random scission that for moderately high initial molecular weight and degree of degradation, the average molecular weight of the degraded polymer is not very dependent on either 1) the original molecular weight, or 2) the original molecular weight distribution. This is evident from considerations developed in detail in the Appendix,* to which reference should be made for the derivation of equations used in this and the following sections.

In equations 1 to 9 of the Appendix, it is shown that the degraded weight average molecular weight, M_w, resulting from random scission can be expressed as a simple function of the total weight of polymer W and the total number of chain cuts (i.e., bonds broken), R:

$$M_w = 2\frac{W}{R}$$

provided the original molecular weight and extent of degradation are moderately high. Two experiments may be cited to show that the present system degrades according to the requirements of this representative random scission.

Influence of Original Molecular Weight on Degradation—One hundred-cc. samples of 1% dimethyl formamide solution of two polymers of different intrinsic viscosities (Samples A and B) were degraded by addition of 2 cc. of aqueous NaOH of different concentrations to 0.1 N. Relative flow times of the reacted solutions were measured and intrinsic viscosities calculated. The results are given in Fig. 2, in which intrinsic viscosity is plotted versus moles of base added per gram of polymer.

It will be noted that the decrease

[2] Jellinek, H. H. G., Trans. Far. Soc. *40*, 266-279 (1944); *44*, 345-349 (1948).

Table III—Recovery and Nitrogen Content of Degraded Polyacrylonitrile

Sample	Normality NaOH added	Intrinsic viscosity	Polymer recovered	Nitrogen content
			g.	%
1A	0 (control)	3.3	4.51	25.6
1B			4.42	25.8
2A	0.05	0.8	4.61	25.6
2B			4.61	25.5
3A	0.075	0.6	4.19	25.6
3B			4.55	25.6
4A	0.10	0.4	4.29	25.5
4B			4.58	25.6
5A	0.20	0.2	4.51	24.9
5B			4.34	25.7
6A	1.00	0.1	4.66	21.7
6B			4.70	22.3

*The Appendix appears on p. 179 ff.

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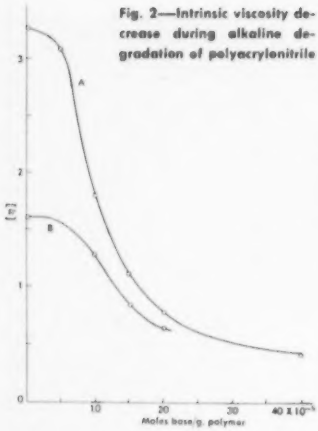

Fig. 2—Intrinsic viscosity decrease during alkaline degradation of polyacrylonitrile

in intrinsic viscosity for the polymer of higher intrinsic viscosity is much more pronounced than that for the polymer of lower intrinsic viscosity in the range 0 to 10×10^{-5} moles base, but further addition of base affects the two partially degraded polymers in essentially the same way. The influence of the original intrinsic viscosity has already disappeared when only a few bonds per molecule have been broken. Consider, for example, sample B degraded to an intrinsic viscosity of 1.3 (about 80% of the original intrinsic viscosity); 10^{-4} moles base/g. polymer are required for this amount of degradation. To degrade sample A to the same intrinsic viscosity requires 1.33×10^{-4} moles/g., an excess of 3.3×10^{-5} moles/g. Shifting the upper curve to the left a distance corresponding to 3.3×10^{-5} moles/g. makes the curves coincide for further increments of base.

Influence of Original Molecular Weight Distribution—A blend of 57% by weight of polymer of intrinsic viscosity 1.0 and 43% of polymer of intrinsic viscosity 4.6 was made up in 1% concentration in dimethyl formamide. The intrinsic viscosity of the mixture was 2.5. To 50 cc. of solution was added 1 cc. 0.1 N aqueous NaOH. The solution was diluted to c = 0.4 g./100 cc. and the relative flow time determined. A whole polymer of about the same intrinsic viscosity as the blend was treated in the same way. The data are summarized in Table IV. The blend, which had a considerably broader distribution than the whole polymer, degraded to essentially the same intrinsic viscosity as the whole polymer.

Under the conditions mentioned (moderately high initial molecular weight and degree of degradation) then, interpretation of results unambiguously in terms of a stoichiometric relation does not require either sharp fractions for starting material or a survey of molecular weight dependence.

The intrinsic viscosity of the degraded polymer as a function of the moles of sodium hydroxide added was calculated from flow time measurements on 1% solutions of polymer which had been reacted with 2 cc. of aqueous NaOH; the amounts of base varied from 0 to 2×10^{-3} moles of base per gram of polymer. The derivation of an expression relating the degraded intrinsic viscosity and the moles of base added to the efficiency, k, of the base in producing scission is given in the Appendix, equations 10 to 14. The result (equation 14, Appendix) is:

$$[\eta]^{-3/2} = \frac{k\,(M_w)_o\,B}{2\,[\eta]_o^{3/2}\,W}$$

Where $[\eta]$ = degraded intrinsic viscosity, $[\eta]_o$ = original intrinsic viscosity, $(M_w)_o$ = original weight average molecular weight, B = moles base added, W = weight of polymer, and k = efficiency of base in producing scission, defined by R = kB, where R is total number of chain cuts produced by B moles of base.

In Fig. 3 the data are plotted according to this result ($[\eta]^{-3/2}$ versus B/W). Aside from a deviation near the origin (in which region the analysis leading to equation 14 does not apply) a linear relation was found with slope equal to 1.2×10^{-4}, from which

$$k = \frac{1.4 \times 10^{5}}{(M_w)_o}$$

M_w has not been determined for this polymer; estimating it to be twice M_n, i.e., about 200,000, leads to a value of k of the order unity. This estimate cannot be refined without a determination of M_w, but to a good approximation it can be said that only one or two base molecules are required to break one bond.

Table IV—Effect of Molecular Weight Distribution on Degradation of Polyacrylonitrile

Sample	Intrinsic viscosity original	Intrinsic viscosity degraded
Blend	2.5	0.71
Whole polymer	2.7	0.66

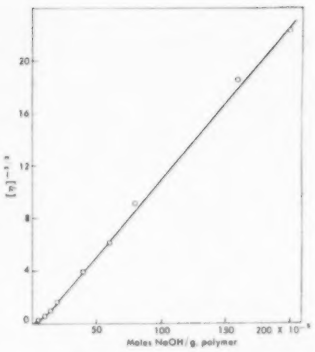

Fig. 3—Stoichiometric relation existing in the alkaline degradation of polyacrylonitrile

It is evident from Fig. 3 that the degradation still follows the theoretical expectations for random scission at the highest degree of degradation. There is no indication of a decrease in slope of the curve such as would occur, for example, if the base attacked flaws or "weak links" in the chain.

Furthermore, in order to produce the observed intrinsic viscosity at the highest degree of degradation, about 300 bonds per molecule on the average (nearly 10%) have to be broken and the number of flaws per molecule according to infrared observations must be considerably less than this.

Proposed Reaction Mechanism

From the experiments just discussed the following remarks may be made about the reaction between polyacrylonitrile and dilute base: 1) The reaction proceeds by random scission. 2) Only one or two base molecules are required to break a bond. 3) The reaction rate is solvent dependent, and proceeds very rapidly in dimethyl formamide. 4) Reaction between solvent and base reduces the over-all effect. 5) Depolymerization by "unzipping" the chain does not occur to any measurable extent. 6) Reaction between base and flaws in the molecules is not important in the degradation. 7) The reaction is characterized by the rapid formation of a bright yellow color which deepens on standing to a deep red-orange. The latter stage of color

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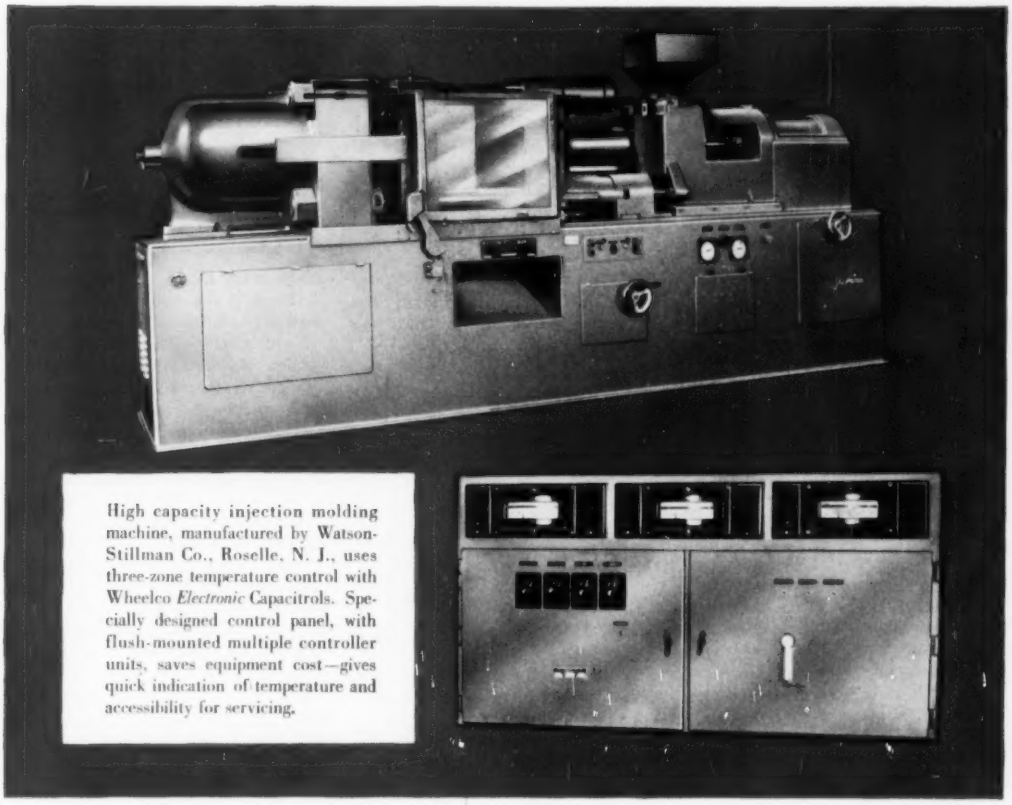

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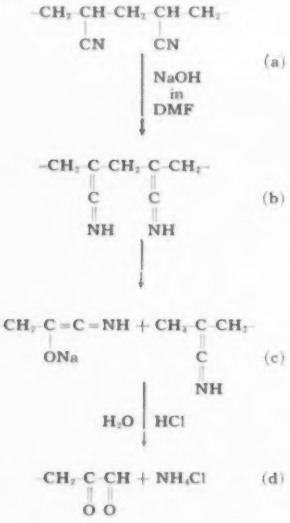
formation is partially reversible in the presence of excess acid.

A theory of the reaction, then, should involve a reaction between base and "normal" (1, 2 addition) polymer. Marvel[3] advanced a theory that is in agreement with the observations and is supported by the results of further experiments suggested by the theory. It was suggested that polyacrylonitrile in dilute dimethyl formamide solution reacts with sodium hydroxide as follows:

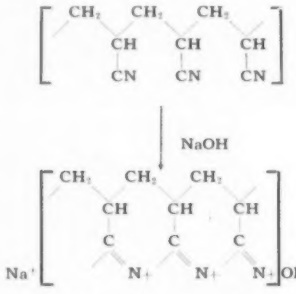


The importance of the α-hydrogen in this theory suggested as a first experiment an investigation of the degradation of polymethacrylonitrile, since this latter polymer lacks the α-hydrogen characterizing polyacrylonitrile. To 40 cc. of 1% polymethacrylonitrile in dimethyl formamide was added 1 cc. 0.2 N aqueous NaOH. A portion of this solution was reserved for flow time measurement and 30 cc. of the remainder reacted with 1 cc. of 0.2 N aqueous NaOH. The flow times relative to 1% solution containing the same amount of water are recorded in Table V.

A slight drop in intrinsic viscosity with the initial addition of base is indicated, but this was probably due to a change of configuration of the molecules in solution due to basic solvent environment as shown by the fact that further addition of base produced only a very slight further change in flow time. Polyacrylonitrile degraded under the same conditions would have a solution flow time (relative to the unreacted solution) of only about 0.2 Polymethacrylonitrile therefore does not degrade in dilute base.

It was observed that although polymethacrylonitrile did not degrade in dilute base, the dimethyl formamide solution went through essentially the same color cycle as does polyacrylonitrile solution; i.e., a bright yellow color formed which deepened to orange on standing. Thus the scission reaction is not involved in the color formation.

The role of the solvent in the color formation was checked by adding aqueous caustic to an acetone solution of polymethacrylonitrile; the color cycle was essentially the same as in dimethyl formamide solution, although the final orange color was lighter. The initial yellow and orange colors observed in the reaction of base with polyacrylonitrile, accordingly, do not involve either the degradation reaction or interaction with the solvent, but are characteristic of a reaction involving the cyano side groups. One possibility is the formation of naphthyridine type structures induced by the presence of base:



The deep red-orange color which develops in highly degraded solutions may be partially due to after-reactions of the split chains. For example, the α-keto aldehyde product in step (d) of the proposed mechanism may split out HCN to give conjugated colored structures. The most important reaction in this step of the color formation, however, is probably the reaction of the cyano groups with dimethylamine, formed by reaction of the base with dimethyl formamide.

Due to the difficulty in preparing and maintaining strictly anhydrous dimethyl formamide solutions, the importance of water in the reaction was not established. Alcoholic potassium hydroxide, however, was observed to give the same effect as aqueous sodium hydroxide.

Further experimental work will be necessary to elucidate the mechanism of the reaction. A study of the addition to the reaction system of such reagents as *o*-phenylene diamine, which add to dicarboxy groups, would check the proposed step (d).

Table V—Reaction of Sodium Hydroxide and Polymethacrylonitrile

Moles base/ gram polymer	*Flow time*[a]
5×10^{-4}	0.88
12×10^{-4}	0.87

[a] Relative to unreacted solution containing the same weight of polymer and water as the reacted solution.

Molecular Weight Distribution

The initial stage of degradation by random scission is distribution dependent. Since the reaction between polymer and dilute base furnishes a means of degrading the polymer rapidly, the use of the reaction in determining molecular weight distribution in polyacrylonitrile polymer was indicated as a reasonable method of approach.

The specific decrease in weight average molecular weight, $1 - M_w/(M_w)_0$, produced by random scission degradation is proportional to the Z average molecular weight, M_z (equations 15 to 19, Appendix). Distribution may be characterized by comparing M_z and M_w, analogously to a characterization by the ratio M_w/M_n from a comparison of light scattering and osmotic pressure data.[4] In order to use intrinsic viscosity measurements exclusively in the characterization, proportionality between

$$M_w \text{ and } [\eta]^{3/2}$$

is assumed. A distribution characterizing parameter, D, proportional to M_z/M_w, is then defined (equation 20, Appendix) by

$$D\left(\frac{B}{W}\right) = [\eta]^{-3/2}\,[1 - ([\eta]/[\eta]_0)^{3/2}]$$

and can be determined by measuring

[3] Marvel, C. S., private discussion.

[4] Lansing, W. D., and Kraemer, E. O., J. Am. Chem. Soc. 57, 1369-1377 (1935).

(*Continued on p. 179*)

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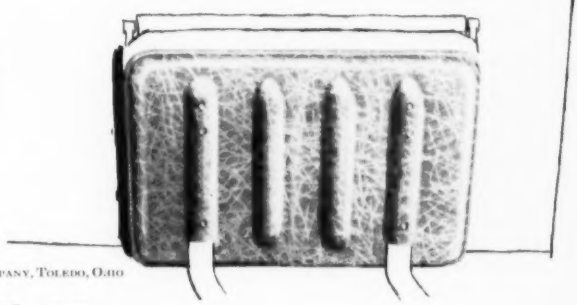

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General

DEVELOPMENTS IN EASTERN GERMANY. Brit. Plastics *26*, (Jan. 1953). A few recent developments in the plastics industry in Eastern Germany are described. These include rigid poly vinyl chloride fenders for motor cars, silicone resins, silicone resin coatings for copper and aluminum wire, resin impregnated graphites for chemical equipment, acrylic plastic dental and surgical devices, nylon fibers, and amino resins.

Materials

CROSSLINKING OF POLYTHENE IN THE ATOMIC PILE. Brit. Plastics *26*, 79-81 (Mar. 1953). Remarkable changes in the structure and properties of polythene are brought about by exposure to high-energy radiation in an atomic pile. Polythene is transformed into a thermosetting material by a crosslinking process with a subsequent change in properties. The degree of crosslinking and the amount of change in the properties is dependent upon the dose. The changes are permanent and irreversible. A change in appearance from milky white through yellow and brown to a transparent dark amber occurs. The solubility in organic solvents at elevated temperatures (above 80° C.) decreases depending on the dosage. Polythene no longer melts at 110 to 120° C. but instead becomes an amorphous gel above these temperatures and does not melt even at 300° C. Young's modulus decreases at first with mild irradiation but increases with a heavier dose. The mechanism of the crosslinking is discussed. Hydrogen gas is liberated which means an unsaturated carbon atom is left to crosslink with another carbon atom. The degree of crosslinking can be deduced from the amount of gas evolved. Several curves and equations also measure the degree of crosslinking by means of weight change and radiation dose. A method for determining molecular weight may be developed involving the solubility-degree of crosslinking relationship. Similar results have been noted with polystyrene, nylon, and unvulcanized rubber.

CURING OF EPOXIDE RESINS. E. S. Narracott. Brit. Plastics *26*, 120-23 (Apr. 1953). The mechanism of curing of epoxide type resins by various chemicals is discussed. Curing by amines is by far the most important to the applications of epoxide resins in the plastics industry and related fields. Theoretically, addition reactions of mono-primary amines cannot give rise to cross-linked chains and, in actual fact, only very few mono-primary amines are useful curing agents for epoxide resins. In the case of primary diamines, such as diethylene triamine, there is no doubt that the addition mechanism is vastly predominant. In the curing of epoxide resins with tertiary amines, the cure is effected catalytically by polymerization through the epoxy groups. In the case of acid-curing agents, the reaction appears to involve not only cure through the epoxide groups but also through the hydroxyl groups. In effecting cure of higher molecular weight epoxide resins, marketed for surface coatings, by the use of urea-formaldehyde or phenol-formaldehyde resins, it is generally assumed that the butylated methylol groups present in the molecule of curing resin form ether linkages with two or more molecules of epoxide resin and so serve to cross link the resins by chemical means.

Molding and Fabricating

FUTURE EXTRUSION STUDIES. C. H. Jepson, Ind. Eng. Chem. *45*, 992-3 (May 1953). The papers of the 1952 A.C.S. extrusion symposium have used the literature of extrusion where possible and developed some new ideas where required, in order to form an understanding of the basic theory of extrusion. Although this development is based on an idealized case, it has been shown by examples that these principles can be put to practical use in the design of extruders to handle melts (or any viscous fluid) and to predict the performance of large extruders from tests of models. An additional and equally important effect of an understanding of extrusion theory is to permit more efficient operation of extruders by substituting rational thinking for the trial and error procedures frequently used. Important problems requiring work are discussed.

SHELL-MOULDING MACHINE STEPS UP FOUNDRY PRODUCTION. Brit. Plastics *26*, 60-61 (Feb. 1953). An automatic shell molding machine is described which has an output equal to that of four shell mold hand operators. Sixty complete molds (120 half molds) can be produced per hour. Four stations operate on a continuous time basis. Three are curing in the oven while the other is being prepared. The heated pattern plate is sprayed with a stripper; the pattern plate is rolled over the mouth of the investment bin, clamped in place, and the entire unit inverted. After a few seconds the reverse procedure occurs and the pattern plate with the sand shell passes through the oven to cure. Automatic controls keep the operation variables constant. Pattern plates can be changed without shutdown. Automatic ejection is employed.

NEW GRANULATING MACHINE FOR THERMOPLASTICS. Brit. Plastics *26*, 26-27 (Jan. 1953). A new French granulating machine is described.

BLOW EXTRUSION OF THIN VINYL FILM. Brit. Plastics *26*, 24-25 (Jan. 1953). The blow extrusion process for making vinyl plastic film is described.

NEW TRENDS IN THE PRINTING AND FINISHING OF VINYL SHEETING. D. G. Higgins, Brit. Plastics *26*, 82-85 (Mar. 1953). The converted vinyl film industry is reviewed. Various methods of printing, laminating, and embossing techniques, how quality is affected by conversion, and some probable future trends in the decoration of vinyl sheet are described. A survey of the industry indicates interest in many of the methods. Diagrams explain the difference in the various methods of printing such as rotogravure, surface printing, etc. Diagrams also explain the procedures of

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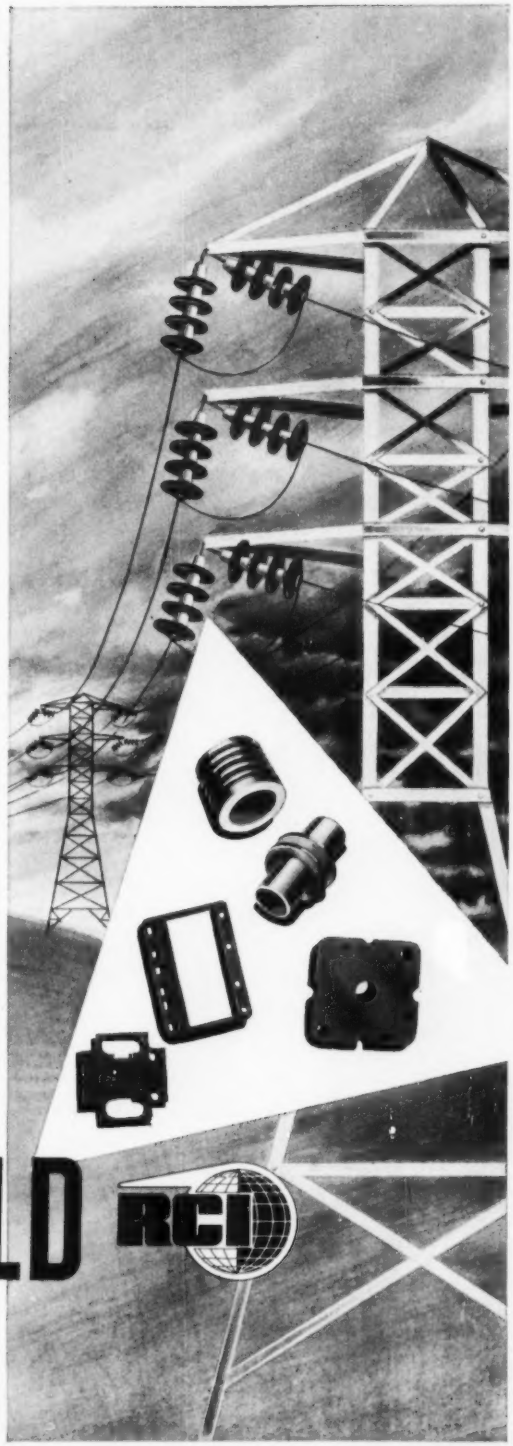

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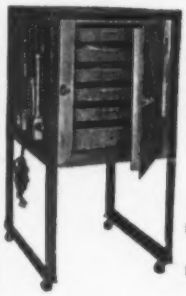

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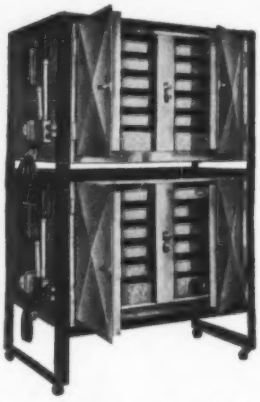

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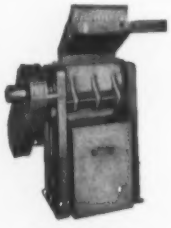

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embossing and laminating. Poor conversion processing has a bad effect on the strength properties, tear resistance, and dimensional stability of the film material.

Applications

ICE CREAM IN PLASTICS. Modern Packaging *26*, 89 (Feb. 1953). Ice cream is packaged in a container molded of polystyrene.

VACUUM-PACKED HOSIERY. Modern Packaging *26*, 82-83 (Feb. 1953). Hosiery is packaged in a transparent plastic film envelope made by laminating a film of cellulose acetate and a film of rubber hydrochloride.

SOME FEATURES OF THE SHELL MOLDING PROCESS. Brit. Plastics *26*, 14-18 (Jan. 1953). Modifications and details of technique of the shell molding process as developed by one British resin manufacturer are described.

PVC SHEET SHOWS ITS MEDALS. Plastics (London) *17*, 314-17 (Nov. 1952). Recent applications of polyvinyl chloride plastic sheeting are described.

ELECTROSTATIC PROPERTIES OF RUBBER AND PLASTICS. H. A. Endres and W. T. Van Orman. SPE J. *9*, 26-30, 43 (Feb. 1953). The electrostatic properties of rubbers and plastics are reviewed. This property is being used to advantage in the construction of dust and smoke filters. Comparative measurements of the electrostatic properties of various plastics are reported.

Properties

CHEMICAL STRUCTURE EFFECT ON PLASTICS DIELECTRIC PROPERTIES. H. M. Richardson. Electrical Manuf. *51*, 114-18, 356, 358 (Apr. 1953). A discussion is given of the effect of chemical structures, composition, and formulation of plastics with regard to electrical properties, especially dielectric constants and dissipation factors at various frequencies. A table of 42 commonly used plastic materials contains values of dielectric constants, dissipation factors, volume resistivity, arc resistance, dielectric strength, and water absorption. The discussion includes the effect of polar type molecules, cross-linking in thermosetting materials, fillers and additives, and how they affect each of the properties. The different types of degradation are dis-

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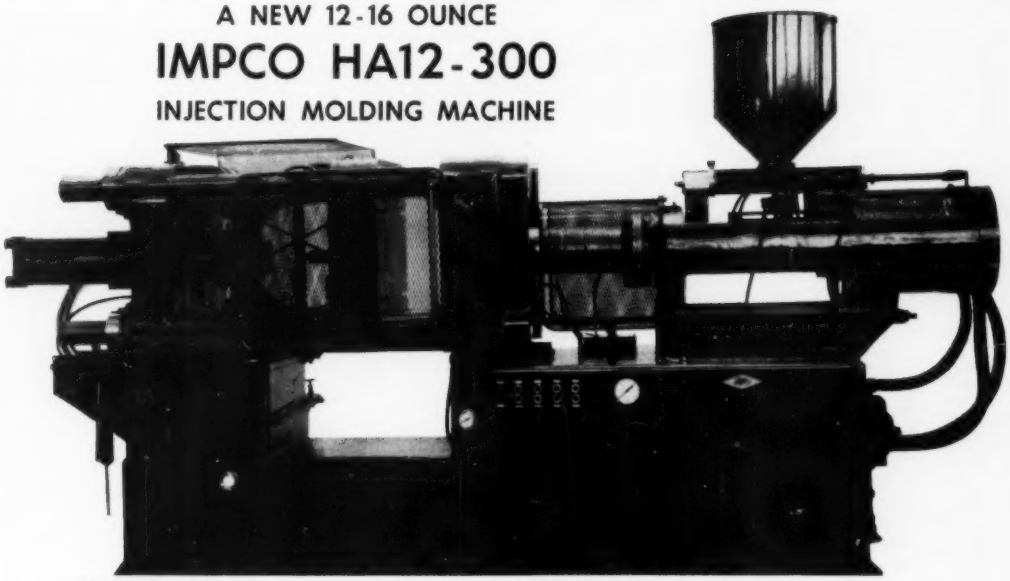

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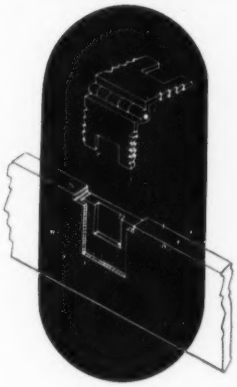

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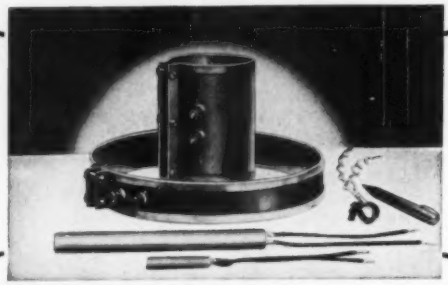

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cussed. High dielectric strength, in general, is associated with unfilled materials. Discontinuities, such as fillers and their associated moisture contents, accelerate dielectric breakdown.

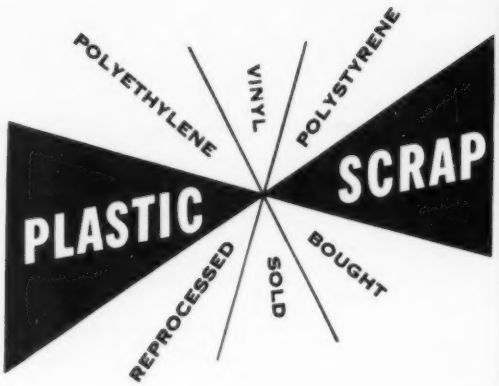
EFFECT OF THE STIFFNESS OF MOLECULES ON THE POLYMER PROPERTIES. A. J. Staverman. Plastica 5, 318-21 (Oct. 1952). (In Dutch). The influence of the stiffness of long chain molecules on the properties of their polymers is discussed. A number of experimental polymers which possess exceptional properties due to the stiffness of the molecules are listed together with nylon, Teflon, and terylene. Some theoretical considerations are given and the importance of molecular stiffness for technical applications is demonstrated.

Testing

DROP METHOD FOR THE DETERMINATION OF THE ARC RESISTANCE OF ELECTRICAL INSULATING MATERIALS. W. Woebcken. Kunststoffe 42, 253-56 (Sept. 1952). It has been difficult to evaluate numerically the arc resistance of the many synthetic organic materials that fall between the two extremes of the phenolics which have very low arc resistance and the ceramics which show hardly any tracking. A new drop method with an automatic drop dispenser is described giving reproducible results.

AN IMPROVED FADEOMETER. L Boor and S. L. Trucker. ASTM Bulletin No. 189, 38-43 (April 1953). Three of the important factors which determine the chemical changes associated with weathering are light, temperature, and moisture. In commercial machines designed to simulate outdoor weathering, these factors are not controlled to the degree of precision comparable to that of the various instruments now in use for measuring changes in such properties as reflectance and transmission. A weathering apparatus using the Atlas type enclosed arc as the light source was built in which the temperature and relative humidity of the air in contact with the specimens are controlled and are variable over a wide range of ambient conditions. The design of the apparatus and the means of achieving control of these variables are described. The effects of varying ambient temperatures and relative humidity during fading tests on National Bureau of Standards Paper 1554 are shown. Studies of fading rates made under the same variable conditions on textiles and plastics confirm the importance of close control of ambient temperature and relative humidity during light exposure.

EVALUATION TESTS FOR MOLDED PLASTICS MATERIALS. A. L. Coats and C. Pomeroy. Elec. Manuf. *51*, 100-4, 302, 304 (Jan. 1953). Tests which one manufacturer of electrical equipment has found to be of importance in selecting plastics to meet his particular needs, principally as dielectrics, are discussed. These tests are concerned with the effect of temperature on insulation resistance, the effect of relative humidity on insulation resistance, the arc resistance when measured by ASTM Method of Test D495-48 and a rotary arc test method, and the effect of altitude on the resistance to spark atmospheres. Information is given on usefulness of several standard test methods and the reason for some laboratory-to-laboratory variability with these test methods.



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POLYESTERS. H. F. Wakefield, S. J. Schultz and S. H. Richardson (to Carbide and Carbon). U.S. 2,630,419, Mar. 3. Polyester resins modified with complex metal-phenol-nitrogen compounds.

ADHESIVE. C. E. Gleim (to Wingfoot). U.S. 2,630,420, Mar. 3. Butadiene-acrylonitrile, phenol-aliline-formaldehyde resin adhesive.

STABILIZER. G. S. Stamatoff (to Du Pont). U.S. 2,630,421, Mar. 3. Stabilizing polyamides with 2-mercaptobenzimidazole.

POLYESTERS. M. M. Brubaker (to Du Pont). U.S. 2,630,422, Mar. 3. Polymeric hydroxy esters.

POLYAMIDES. R. N. MacDonald and C. W. Tullock (to Du Pont). U.S. 2,630,423, Mar. 3. N-carboanhydrides and polyamides.

POLYMERS. W. F. Gresham (to Du Pont). U.S. 2,630,424, Mar. 3. Polymers of formal esters.

CHLOROSULFONATED POLYMERS. E. A. Rodman (to Du Pont). U.S. 2,630,425, Mar. 3. Curing chlorosulfonated hydrocarbon polymers with polyvalent metal ion producing materials.

ION EXCHANGE. J. C. H. Hwa (to Rohm and Haas). U.S. 2,630,427-8-9, Mar. 3. Strongly basic and weakly basic anion exchange resins.

COPOLYMERS. E. C. Shokal and P. A. Devlin (to Shell). U.S. 2,630,430, Mar. 3. Allyl alcohol-styrene copolymers.

EXTRUSION. L. K. de Lauberede. U.S. 2,631,016, Mar. 10. Homogenizing device for extruding machines.

CELLULOSIC PRODUCT. D. V. Redfern (to American-Marietta). U.S. 2,631,097-8, Mar. 10. Cellulosic fiber product bonded with thermosetting resin.

ION EXCHANGE. G. F. D'Alelio (to Koppers). U.S. 2,631,127, Mar. 10. Sulfonated resin.

RESIN. H. Dannenberg (to Shell). U.S. 2,631,138, Mar. 10. Curing resin-forming compositions with sulfonic acids.

RESINS. H. S. Bloch (to Universal Oil Products). U.S. 2,631,140, Mar. 10. Modified phenolic resins.

COPOLYMERS. D. Swern and E. F. Jordan, Jr. (to U. S.). U.S. 2,631,141, Mar. 10. Copolymers of phthalic acid esters.

TUBING. C. G. Reber (to Plax). U.S. 2,631,332, Mar. 17. Apparatus for forming gusseted seamless thermoplastic tubing.

FILMS. J. S. Bailey (to Rauland). U.S. 2,631,334, Mar. 17. Producing thin free films of nylon.

FLOOR COVERING. F. C. Schueler (to Schueler Engineering). U.S. 2,631,643, Mar. 17. Apparatus for production of vinyl floor covering.

FILM. W. M. Bright (to Kendall). U.S. 2,631,954, Mar. 17. Polyethylene film.

BONDED ARTICLE. I. E. Muskat (to Marco). U.S. 2,631,955, Mar. 17. Resin bonded fibrous material.

COATING. C. S. Francis, Jr. (to American Viscose). U.S. 2,631,958, Mar. 17. Transfer coating thermosetting resin onto a fabric.

WOOD SURFACING. E. H. Dafter, Jr. (to American Cyanamid). U.S. 2,631,960, Mar. 17. Surfacing wood with fabric and thermosetting resin.

POLYMERIZATION. J. K. Lawson, Jr. (to American Viscose). U.S. 2,631,975, Mar. 17. Photopolymerization of vinyl trifluorochloroethyl ether.

INTERPOLYMERS. R. A. Crawford and R. T. Morrisey (to B. F. Goodrich). U.S. 2,631,984, Mar. 17. Isoolefin polyolefin interpolymers.

EMULSIONS. R. E. Davies and S. B. McFarlane (to Celanese). U. S. 2,631,987, Mar. 17. Emulsions of polymethyl vinyl ketone.

PLASTICIZERS. M. L. Fein and C. H. Fisher (to U. S.). U.S. 2,631,988, Mar. 17. Mixed plasticizers for polyvinyl chloride-acetate.

POLYMERS. J. J. Padbury (to American Cyanamid). U.S. 2,631,989, Mar. 17. Acrylonitrile polymer and 2-p-dioxanone.

STABILIZERS. G. P. Mack and F. B. Saverese (to Advance Solvents). U.S. 2,631,990, Mar. 17. Stannanediol ether esters as stabilizers for halogen resins.

RESINS. T. Boyd and H. A. Walter (to Monsanto). U. S. 2,631,991, Mar. 17. Pyrazoline resins.

POLYAMIDE. S. B. Speck (to Du Pont). U.S. 2,631,992, Mar. 17. Polyamide from disubstituted malonic acid.

POLYCARBONAMIDE. P. W. Morgan (to Du Pont). U.S. 2,631,993, Mar. 17. Insolubilization of polycarbonamides containing tertiary nitrogen.

COPOLYMERS. H. A. Bruson (to Industrial Rayon). U.S. 2,631,995, Mar. 17. Copolymers of acrylonitrile.

COPOLYMERS. F. G. Pearson (to American Viscose). U.S. 2,631,998, Mar. 17. Copolymers of trifluorochloroethylene and 1-fluoro-1-chloroethylene.

ION EXCHANGE. E. L. McMaster, R. M. Wheaton, and J. R. Skidmore (to Dow). U.S. 2,631,999,-2,000-1, Mar. 17. Ion exchange resins from primary or secondary amines and methyl styrene polymers.

ORGANOSILICON COMPOUNDS. G. H. Wagner and C. O. Strother (to Union Carbide and Carbon). U.S. 2,632,013, Mar. 17. Organosilicon compounds.

HELMET. G. A. Lyon. U.S. 2,632,-173-4, Mar. 24. Plastic helmet.

MOLDING. J. R. Haines (to Injection Molding). U.S. 2,632,202, Mar. 24. Forming hollow plastic articles.

EXTRUSION. L. K. de Laubarede. U.S. 2,632,203, Mar. 24. Apparatus for thermoplastic extrusion.

EXTRUSION. L. T. Murray (to Eastman Kodak). U.S. 2,632,204, Mar. 24. Extrusion of decorative thermoplastic sheets.

FILM. R. F. Pierce (to Visking). U.S. 2,632,206, Mar. 24. Production of plastic film.

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MPS-500 is a stabilized, chlorinated ester of a fatty acid. It shows excellent compatibility with vinyl chloride polymers and copolymers. Its low cost and valuable properties make it well worth investigating, for use alone or with other plasticizers.

• Hooker laboratories are fully equipped to test and evaluate plastic compositions. We are glad to help you solve problems where MPS-500 may be of interest. Your inquiry is invited.

From the Salt of the Earth

HOOKER ELECTROCHEMICAL COMPANY

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Plastics for Defense and Industry

KNOW HOW — The "know how" approach to every phase of plastics engineering and production is, and continues to be, a major factor in the over quarter-century success of the Michigan Molded organization. It is one of many reasons that Michigan Molded's recommendations and performance in doing a plastic job well — justifies the continuing interest and confidence of America's users of all types of plastics.

MICHIGAN MOLDED PLASTICS, INC. DEXTER, MICHIGAN

Offices in Principal Eastern and Midwestern Cities.

207, Mar. 24. Rapid cycle molding of thermoplastics.

BOOKBINDING. F. S. Schade (to National Blank Book). U.S. 2,632,657, Mar. 24. Bookbinder backing of plastic sheet.

PAPER TREATING. W. F. Fowler, Jr. and D. R. Spear (to Eastman Kodak). U.S. 2,632,699, Mar. 24. Styrene alkyl acrylate resin for wet-strength paper.

RESINS. G. E. Niles (to Monsanto). U S. 2,632,700, Mar. 24. Amino resins catalyzed with hydroxy organic sulfonic acids.

MOLDABLE TABLET. H. Libberton (to Tenak Products). U.S. 2,632,722, Mar. 24. Moldable thermoplastic tablet for use in preparation of electrotypes.

BONDING. E. B. Lumbard (to L. A. Goodman). U.S. 2,632,724, Mar. 24. Bonding hollow plastic bodies.

LENSES. A. Marks and M. Marks. U.S. 2,632,725, Mar. 24. Optical lenses laminated with plastic material.

EMULSION. L Schibler (to Ciba). U S. 2,632,740, Mar. 24. Three-phase emulsion of resins.

COATING. L. W. Eckert (to Armstrong Cork). U.S. 2,632,741-2-3, Mar. 24. Fire-resistant coating containing dicyandiamide aldehyde resin.

RESIN. A. M. Howald (to Libbey-Owens-Ford). U.S. 2,632,744, Mar. 24. Polymerized polyester resins of improved strength.

RESIN. H. G. Smith, T. L. Cantrell, and M. L. Hill (to Gulf Oil). U.S. 2,632,745, Mar. 24. Fatty-acid modified phenolic resins.

VINYL HALIDE. J. R. Darby (to Monsanto). U.S. 2,632,746-7, Mar. 24. Fungi and bacteria resistant polyvinyl halide compositions.

RESIN MIXTURES. J. R. Caldwill (to Eastman Kodak). U.S. 2,632,748, Mar. 24 Mixtures of polyacrylonitriles and polyamines.

RESINS. M. Kaufman and A. F. Williams (to C. D. Patents). U.S. 2,632,749, Mar. 24. Acenaphthylene resins.

POLYESTER. T. F. Anderson (to Libbey-Owens-Ford). U.S. 2,632,751, Mar. 24. Stabilized polyester resins.

sparkling sprayer

Rapid injection molding of shatterproof Tenite produces this efficient new hose nozzle for the popular-price market. The four component parts, of transparent green Tenite, are molded to close tolerances and assembled in precision fit. The finished nozzle has characteristic Tenite light weight and durability—weathers well, will not chip or corrode, and successfully withstands as much as 500 lbs. water pressure.

Tenite toughness and ready adaptability to design are reflected today in many fine products for home and industry. This versatile plastic comes in a full range of flows and colors for molding or extruding—often helps effect savings in production time and costs.

For more information about Tenite, write
EASTMAN CHEMICAL PRODUCTS, INC.,
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sales representative for
Tennessee Eastman Company,
Division of Eastman Kodak Company.

Trans-Flo hose nozzle manufactured of Tenite by Vichek Tool Company, Cleveland, Ohio.

TENITE

an Eastman plastic

● Information regarding Tenite is also obtainable through representatives located in Chicago, Cleveland, Dayton, Detroit, Houston, Leominster (Mass.), Los Angeles, New York, Portland (Ore.), Rochester (N. Y.), St. Louis, San Francisco, Seattle, and Washington (D. C.); and elsewhere throughout the world from Eastman Kodak Company affiliates and distributors.

NEW MACHINERY AND EQUIPMENT

HORIZONTAL PELLETIZER—A preformer or pelletizer working on fundamentally different lines from the vertical single stroke or rotary preformer so familiar to the American plastics industry has been developed by B.I.P. Engineering Ltd., England.

In this new machine, the punch and die access are horizontal and the drive is all hydraulic. The accompanying series of diagrams illustrates the pelletizing action. Diagram "A" shows the fill position, where 1 is the fixed punch, 2 the moving punch attached to the hydraulic ram 3, and 4 is the die to which the hopper is attached. The distance between the two punches can be varied by an adjustable back stop on the ram 3 to alter the pellet weight. In the fill position the gap between the punches is under the hopper and powder has just filled this space.

In diagram "B" the die and hopper have been moved by hydraulic jacks (not shown) until the gap between the punches is wholly within the die. At this point the hopper and die are stopped and at the same time the ram 3 moves the right-hand punch in to compress the material and form the pellet. This is shown in diagram "C."

Diagram "D" shows the end of the cycle. The hopper and die have moved to the extreme left and the pellet has been ejected.

With this machine it is possible to make a ring or doughnut pellet by installing a center punch which is fixed in constant relation to the moving die. By another simple conversion it is possible to adapt this machine so that it will produce 2 pellets per cycle.

Damaging the punches, die, or structure of the machine is practically impossible since nothing comes between the punches but powder.

The density of the pellet is always constant, as the same pressure is always applied. Moreover, as the die and hopper are unrestrained at the moment of pressure application, the die can move, thus equalizing the pressure throughout the pellet.

Powder of fairly constant grain size will produce pellets with a weight variation of less than ± 1%; a high percentage of fines will give pellets a weight variation of about ± 2 percent.

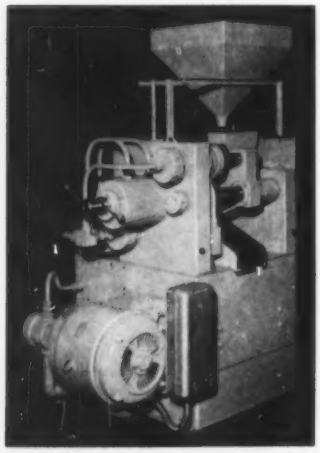
By the addition of a simple agitator to the hopper it is possible to pelletize medium shock materials to a weight accuracy of about 3 percent. This is possible because there is direct access to the gap between the punches in the hopper. Pellets of medium shock material weighing 100 g. can be made 3 in. in diameter with a 1-in. central bore, using the standard 40-ton machine.

This machine can even handle powder which will normally produce a crumbling pellet. A control allows the time during which pressure acts to be extended for several seconds which permits a reasonably compact pellet to be produced.

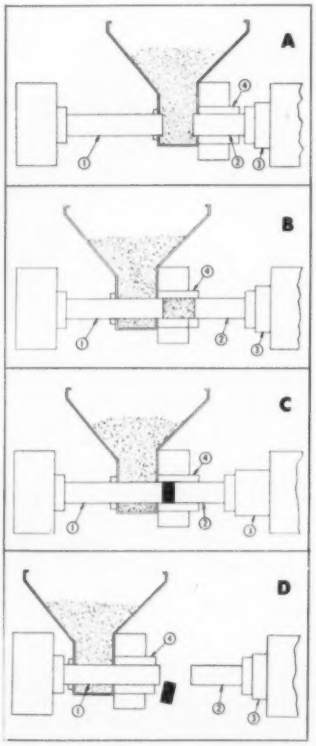
The movement of the crosshead carrying the die and hopper is controlled by two jack rams. Reversal at each end of the stroke and the temporary stop during which the pellet is made are controlled by air pilot valves, and the machine must be supplied with air at a pressure of from 50 to 80 p.s.i. Air consumption is negligible.

Three controllable delays are supplied, one at the filling end of the travel, one at the ejection end, and the third at the compression point. All these delays are simple air control valves.

The hydraulic circuit is designed so that all valves at once go to a neutral position as soon as the air control circuit is exhausted. This stops the machine and causes the pump to circulate oil at zero pressure. A valve for exhausting the air system is the remaining control and makes it possible to run the machine semi-automatically in order



B.I.P.'s 40-ton horizontal pelletizer machine, showing weight adjustment handle and the pellet chute



Diagrams illustrating pelletizing action of new pelleter. Die and hopper are moved by hydraulic jacks

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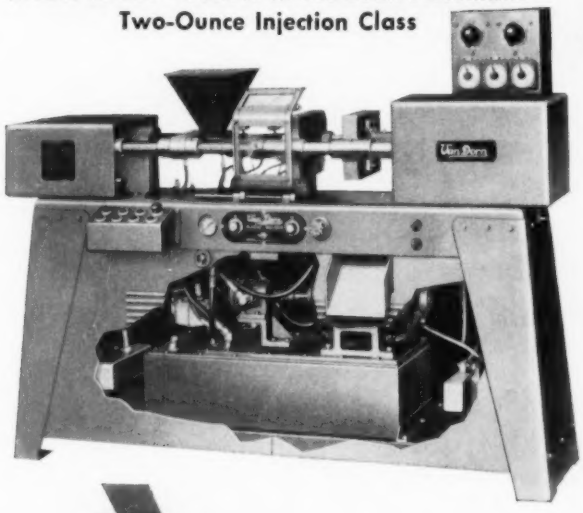
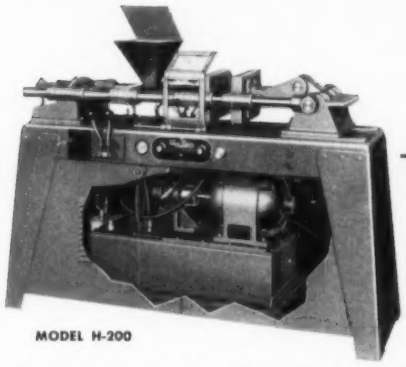
VAN DORN Equipment

Model H-200—Leader in the Semi-Automatic Two-Ounce Injection Class



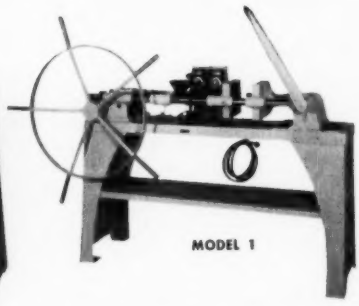
This ultra-modern press molds practically all thermoplastics including nylon. It completes up to 6 operating cycles per minute. Push button controls are safe, simple and convenient. Compact and rugged, the unit is quiet and economical in operation. Sliding gate with interlocking safety devices starts the cycle. Solenoid valves close the molds. Injection and dwell are controlled by first of three timers on the rear panel. Center timer regulates recharging of heater. The third timer controls the length of the mold close cycle; when time runs out, molds automatically open and parts are ejected. Operator opens safety gate, removes product and then closes gate to begin the next cycle . . . Variable voltage transformers in conjunction with thermostatic units control the temperatures on the two heating zones accurately.



MODEL H-200

Power Operated, Lever Controlled Presses

2-oz. or 1-oz. capacity. These low-cost units operate 8 hours for under a dollar and use inexpensive molds. Can easily be set up in twenty minutes by one man.



MODEL 1

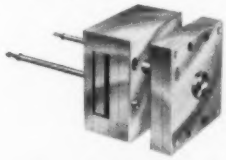
Manually Operated Press

1-oz. capacity. This press is ideal for smaller jobs, experimental work and technical training.

MODEL G-100

Plastic Grinder

Grinds up rejects, waste, etc., for re-use. Ruggedly made, designed for easy cleaning.



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to check pellet weight at the beginning of a run.

Pellets of any weight will normally fall off the punch without assistance, but occasionally a material is found that tends to stick. A mechanical tappet device is used to free the pellet. The blade that taps the pellet is of soft material and projects into the punch area approximately $\frac{1}{16}$ inch.

This 40-ton machine will make $3\frac{1}{8}$-in. diameter pellets at a rate of 22 per min., each pellet weighing 7 oz.; or 572 lb. per hour. If the thickness of the pellet is reduced, the stroke is automatically shortened, and the machine speeded up. At a thickness of 1 in., the output is 24 pellets per min., but the weight per hour falls to 381 pounds.

If a double tool is used, a maximum diameter of $2\frac{1}{8}$ in. is possible, and the maximum output of pellets is doubled; i.e. 44 per min. for a full length and 48 for a 1 in. thick pellet.

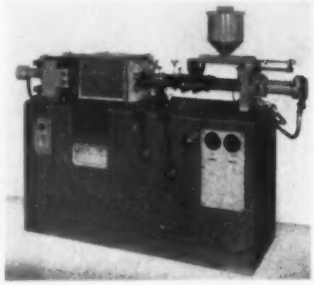
The pelletizer described so far is the medium size unit having a maximum pressure of 40 tons. A smaller machine with a maximum load of 14 tons and a maximum single tool speed of 40 per min., and a larger machine of 80-ton capacity, having a maximum single tool speed of 16 per min. are also made. The larger machine can handle nearly 1000 lb. per hr. when making pellets $4\frac{3}{8}$ in. in diameter, and can, if necessary, produce two 3-in. diameter pellets at a rate of 32 per minute.

The maximum pellet sizes given correspond to a pressure on the material of approximately 12,000 p.s.i. Most plastic powders should make a reasonably hard pellet at this figure, but where powder of poor compacting quality is encountered the capacity of the machine may have to be restricted to increase the material compression to a value of about 22,000 p.s.i.

Close-up of punches, knock-off blade, and pilot valve gear on new B.I.P. machine. Unit is in ejection position

INJECTION MACHINE—Model 71, a 1-oz. horizontal hydraulic injection molding machine developed by Moslo Machinery Co., 2443 Prospect Ave., Cleveland 15, Ohio, has a four-point double toggle which provides uniform locking of the mold and is operated at 32-ton clamping pressure.

The unit has a plasticizing capacity of 12 lb. per hr. at an operating temperature range of 150 to 650° F. The hopper holds 8 lb. of material and, to insure an exact amount of material for each shot, a metering device is employed. Heat is regulated by two heat percentage timers, two indicating thermometers, and two thermostats. Two hand levers control the hydraulic operation of the clamping mechanism and injection stroke. Maximum pressure on material cylinder at 1250 p.s.i. on oil is 10,200 p.s.i.



Moslo's Model 71 injection machine has hand-lever control of toggle clamping mechanism and injection stroke

The injection cylinder is water cooled to reduce sticking; and plasticizing material cylinder, nozzle, and spreader are chrome plated. When the machine is not in use, a safety gate protects the mold. Aside from its industrial applications, the unit is being promoted for use in experimental laboratories and schools.

HOPPER LOADER—A new motor-driven conveyor unit for injection and extrusion machines, which mechanically feeds material from container to hopper, has been announced by Thorenson-McCosh Inc., 18208 W. McNichols Rd., Detroit 19, Mich.

The loader feeds material to the hopper at a rate of from 20 to 30 lb. per min. to a height of 10 feet. A clock timer, set by the operator, starts and stops the flow of material, eliminating all hand-feeding operations. The unit fits any injection or extrusion machine, and can also be supplied in portable form.

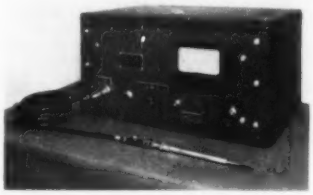
QUALITY CONTROL—Continuous and effectively instantaneous measurement and control of viscosity is made possible by the Ultra-Viscoson, a measurement-control device produced by Cincinnati Div., Bendix Aviation Corp., 203 W. 3rd St., Cincinnati 2, Ohio.

Containing no moving parts, the instrument consists of a small sensing element, or probe, which is immersed in the liquid under test, and an electronic computer. A thin alloy steel blade in the end of the probe is excited by pulses of ultra-high-frequency sound waves. This ultrasonic energy causes the steel blade to vibrate to an extent determined by the viscosity of the fluid under examination.

The computer functions to translate variations in vibration into dial readings on a control panel, or into a continuous viscosity curve on an electronic recording instrument. Since the computation is electronic, there is practically no time lag between testing and recording; thus changes in the flowability of any liquid can be almost instantaneously detected and corrected.

The probe is designed for permanent installation in a pipeline, kettle, or fractionating tower, and can operate in high-pressure or vacuum containers over a temperature range of −200 to 650° F.

For the plastics industry, a spe-



Bendix's Ultra-Viscoson has probe and computer for instantaneous and continuous measurement of viscosity

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Modern farming techniques call for hygienic and well-lit barns, byres and sheds. To ensure the maximum daylight in their out-buildings farmers specify corrugated 'Perspex'. This acrylic sheet is simple to fix, is available to match any standard roofing corrugations, whether the roof is straight or rounded, and transmits no less than 92% of natural light. When used for cattle sheds it benefits the stock too, since corrugated 'Perspex' transmits health-giving ultra violet light.

I.C.I. also serves the farmer by supplying tough, flexible 'Alkathene' tube, made from the I.C.I. brand of polyethylene. This tubing answers the farmers' need for water service lines that are adaptable and easy to install, proof against frost bursts and immune to corrosion from soils or water.

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P.528m

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This hydraulically powered unit is made in widths from 39" to 84", and is synchronized in with the calender. It actually increases production . . . because it may be used to *decrease* the gauge of the material as it comes from the calender and polish it in a single operation. An operator is not needed.

Liberty Machine Co. also makes high chrome cylinders, embossing machines, printing presses, inspection units and other equipment for plastic sheet processing. Write for details on these units. LIBERTY MACHINE CO., INC., 275 Fourth Avenue, Paterson 4, New Jersey.

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LIBERTY MACHINE CO., INC.

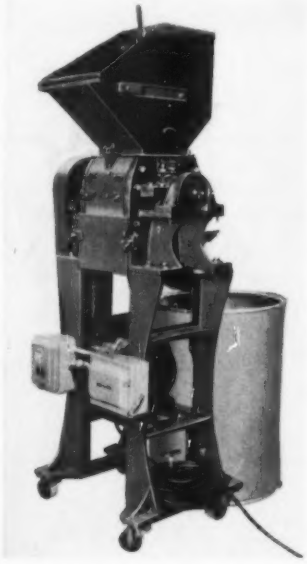
cial model of the instrument will feature six probes and one computer for the continuous monitoring of the viscosity of plastics compounds in up to six kettles.

MIXER—Designed for use on dry, semi-dry, and pasty materials, two new mixer models have been made available by National Engineering Co., 549 W. Washington Blvd., Chicago 6, Ill.

Model 2F has a batch capacity of 30 cu. ft., model 3F of 60. Tradenamed Mix-Muller, the units are intended for use where intensive controlled mulling is needed to obtain and maintain uniformity in the dispersal of pigments and/or plasticizers.

The mixer is also available in ½ and 3 cu. ft. models for laboratory and portable use.

GRANULATOR—Redesigned Laboratory "251" Granulator has an 8- by 8-in. throat opening to take large sprues and runners, and can granulate directly into any 30-in. drum, eliminating transfer of ground material from bin to drum. The new hopper is said to eliminate fly-back leakage. The unit, produced by Ball & Jewell, Inc., 22 Franklin St., Brooklyn 22, N.Y., has a capacity of 100 to 150 lb. per hour. If desired, it can be provided with a bin receptacle.



Ball & Jewell's Laboratory "251" Granulator has capacity of 100 to 150 lb. per hr., 8- by 8-in. throat opening

CUT LETTERS—Two new reduction ratios, $\frac{7}{16}$ and $\frac{5}{16}$, have been added to the range of cut letters being produced by Green Instrument Co., Cambridge, Mass. Reduction ratios of ½, ⅜, and ¼ of the master size type in various styles which range from $\frac{3}{16}$ to 2 in. in height are also available.

TRIM TOOL—A carbide tipped double-shear-angle trim tool for the finish beveling of plastic top edges has been announced by North American Products Co., 3103 W. Cherry St., Milwaukee 8, Wis. The tool has three interchangeable arbors with bearing guides of different diameter, enabling the operator to obtain new cutting edges without interrupting the tool setting.

WINDER—Uniformity of tension throughout the diameter of a roll in a winding operation is maintained by the Alquist winder offered by Hobbs Mfg. Co., Machine Div., 26 Salisbury St., Worcester 5, Mass.

Suitable for either left- or right-hand winding, the unit has its own motor and thus operates independently of the machine itself. Degree of tension can be set at the start of a roll and is maintained automatically at that value from core to final circumference.

The winder is said to be capable of handling light and heavy materials equally well, and can be designed to maintain whatever speed is required to handle material as it comes from the preceding operation.

MILL-TRACER-PROFILER — Automatic leveling of the table and automatic gib locking devices are two of the features of the Hydro Micro-Tel vertical tracing, profiling, and milling machine, available from DeWitt Lewis Co., 3629 Sophia St., Wayne, Mich.

Hydraulic tracing accuracy to 0.001 in. and electronic tracing or profiling accuracy to 0.0002 in. is claimed for the machine. The unit is said to have spindle selective power feed and depth control to 0.0001 inch.

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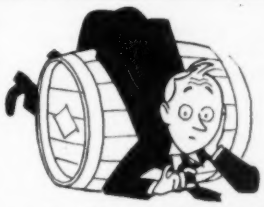

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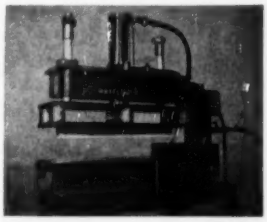

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BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"1952 Book of ASTM Standards"

Published in 1953 in seven parts by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 9975 pages. Total price $76.00

This latest edition of the ASTM book of standards lists more than 2000 standards, specifications, tests, and definitions for materials. It consists of seven parts, each of which may be purchased separately, as follows: Part I: Ferrous Metals—291 standards, 1602 pages, $12.00. Part II: Non-Ferrous Metals—268 standards, 1359 pages, $10.00. Part III: Cement, Concrete, Ceramics, Thermal Insulation, Road Materials, Waterproofing, and Soils—405 standards, 1666 pages, $12.00. Part IV: Naval Stores, Wood, Fire Tests, Sandwich Constructions, Building Constructions—273 standards, 1182 pages, $10.00. Part V: Fuels, Petroleum, Aromatic Hydrocarbons, and Engine Antifreezes—213 standards, 1282 pages, $10.00. Part VI: Rubber, Plastics, and Electrical Insulation—257 standards, 1520 pages, $12.00. Part VII: Textiles, Soap, Water, Paper, Adhesives, and Shipping Containers —294 standards, 1364 pages, $10.00. Each part is complete with index. To keep the book up to date, a supplement to each part will be issued late in 1953.

"Essentials of Fluid Dynamics," by Ludwig Prandl.

Published in 1952 by Hafner Publishing Co., 31 E. 10th St., New York 3, N. Y. 452 pages. Price $6.00

This is the authorized translation of the author's 1949 edition of *Führer durch die Strömungslehre*, and is intended to be a guide to the beginner as well as the advanced student in the field of fluid dynamics, and to the expert in related areas of research. Complex mathematical analysis has been avoided as far as possible (although a knowledge of differential calculus is required for comprehensive reading of the text), and the use of formulas has been kept to a minimum. Topics discussed include theory of stress, properties of liquids and gasses, kinematics, dynamics of frictionless fluids, motions of viscous fluids, turbulence, fluid resistance, dynamics of gasses, flow in heavy stratified fluids, and others. Practical applications evolving out of the theoretical discussion are presented.

"Textile Fibers, Yarns, and Fabrics," by Ernest R. Kaswell.

Published in 1953 by Reinhold Publishing Corp., 330 W. 42nd St., New York 36, N. Y. 552 pages. Price $11.00

Based on the research results of over 400 investigators, this volume evaluates the engineering, physical, and chemical behavior of synthetic textile fibers, yarns, and fabrics. The first part of the book deals with the intrinsic properties of fibers, such as energy absorption; elastic modulus; repeated stress; chemical, thermal, biological, and environmental resistance; and dyeing characteristics. Part II covers the properties of textile structures which are dependent upon fabric geometry as well as upon inherent fiber characteristics, such as abrasion resistance, crease retention, thermal conductivity, "hand," wrinkle resistance, and air-water permeability. Using wool as a yardstick the author presents a study of all fibers, including such newcomers as Dacron, Vicara, X-51, etc. Written primarily for textile chemists, physicists, and engineers, this book may also be used profitably by those in the fields of plastics, polymers, rubber, leather, and paper.

"Case Studies in Commercial Chemical Development," by John E. Ullmann.

Published in 1953 by Chemonomics, Inc., 400 Madison Ave., New York 17, N. Y. 134 pages. Lithoprint, paperbound. Price $5.00

Product development case histories covering 37 products and 69 companies are presented, some sketchily, some in considerable detail. Products covered include: Krilium, insecticides, antibiotics, Orlon, Alkane, hydraulic fluids, plasticizers, polystyrene, resins, and others. For those interested in a more detailed study of the various products, a bibliography is appended.

"Small Business Management," a publication of the New York State Vocational and Practical Arts Association.

Published in 1952 by Delmar Publishers, Inc., Albany 1, N. Y. 213 pages. Price: $2.75

Divided into eight units, the text covers such topics as general problems of small business operation, basic business law, business forms and records, financial problems, location problems, ordering and inventory, store layout, salesmanship, and advertising.

"Fiber Glass Reinforced Plastics in the Polyester Laminating Field."

Published in 1953 by FRP Associates, 4 Brattle St., Cambridge 38, Mass. 137 pages. Price $10.00.

This report by 8 second-year students at the Harvard Graduate School of Business Administration, is written in partial fulfillment for the requirements of the course in manufacturing, and is intended to be an over-all survey of the fibrous glass reinforced plastics laminating field, with emphasis on polyester glass low pressure laminating. It starts out with a description of the physical and chemical properties of the raw material, continues with a description of molding techniques and machining characteristics, and devotes the remainder of the discussion to the various fields in which fibrous glass reinforced plastics have found application—building and construction, aircraft, automobile, industrial, etc.

Bulk handling—A 16-page catalog describes a complete, mechanical, automatic system for filling, transporting, storing, discharging, weighing, and blending all types of bulk material, including liquids. The system consists of automatic filling and discharging equipment and aluminum bins in three standard sizes. The system is now in use in industries handling a diverse list of products, including flour, sugar, salt, soap, detergents, cocoa, cement, whiting, carbon black, powdered coffee, powdered plastics, fluorescent powders, ethocel, phthalic anhydride, and polystyrenes. The catalog includes photographs of installations,

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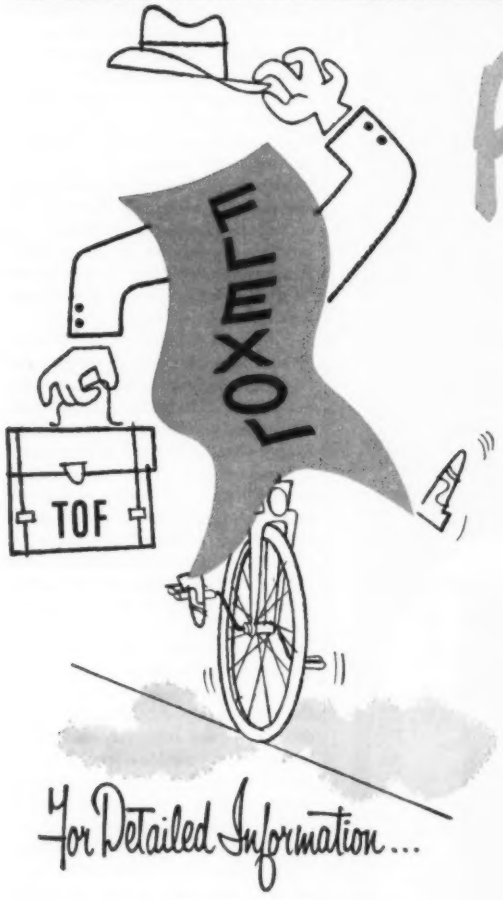

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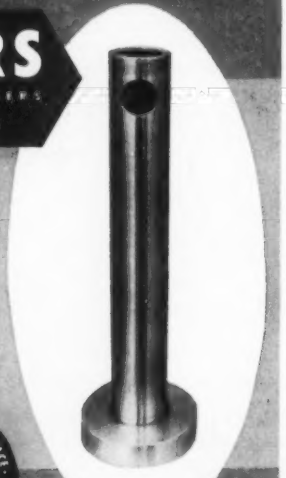

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mechanical diagrams, and basic specifications. Dollar-and-cent savings, which the company claims can be effected through the installation of such a system, are shown in table form. *Tote System, Inc., Beatrice, Nebr.*

Styrene market survey—A study of the distribution channels of styrene plastics housewares from molder to consumer, the potential volume of housewares through each channel, methods of marketing, price lines, mark-ups, and other data pertaining to the marketing and merchandising of plastic housewares is presented in "Styrene Plastic Housewares." Tables giving the major wholesaling and retailing centers in the U.S. and a survey of seasonal patterns and buying trends are also included. *Monsanto Chemical Co., Plastics Div., Marketing Dept., Springfield, Mass.*

Nylon coloring—Equipment and methods used in coloring nylon are outlined in this folder entitled "The Technique of Coloring Nylon." Also described is a line of colors which are non-reactive at all temperatures at which nylon is molded and which have little or no effect on the tensile strength and impact resistance of that material. An available color chart lists the amount of dry colorant used to color 100 lb. of plastic as well as cost of color per lb. of plastic. *Ferro Corp., Color Div., 4150 E. 56th St., Cleveland 5, Ohio.*

Coatings base—A six-page folder describes the manner in which Vinsynite is used on six different types of metal products to promote paint adhesion and corrosion resistance. Pretreating a metal surface with Vinsynite protects it against corrosion for several months; however, if the Vinsynite base is covered with a vinyl, alkyd, phenolic, chlorinated rubber, epoxy, or oleo-resinous coating, the metal is thereby protected against corrosion for extended periods. Choice of finish is determined by the particular application for which the metal product is intended. *Specialty Coatings, Inc., Div. of Thompson & Co., 1085 Allegheny Ave., Oakmont, Pa.*

Acidity test paper—A reference chart shows at a glance the points on the pH scale at which the com-

pany's various pH test papers show positive color changes. Thus, the appropriate papers for testing at each critical pH point can be chosen. For example, if the critical pH value is 6.4, reference to the chart will furnish the catalog number of the paper which will show a positive color change at that point. *R. P. Cargille Laboratories, Inc., 117 Liberty St., New York 6, N. Y.*

Dry-blender—Catalog Section 404 describes operation and features of a twin shell dry blender with intensifier, designed especially for use with the recently introduced shell molding process. In that process, machined patterns of the mold are preheated to 500° F. and then covered with a phenolic resin-sand mix. The heat of the pattern causes resin to flow and surround the sand grains adjacent to the pattern, forming a thin, partially cured shell structure, which is then passed to an oven for full cure. This molding process requires a uniform resin-sand blend, and the twin shell blender with intensifier is designed to accomplish this. *The Patterson-Kelley Co., Inc., E. Stroudsburg, Pa.*

Centrifugal pumps—Construction data on a line of single-stage, double-suction centrifugal pumps are provided in this 24-page bulletin, 08B6146B. The pumps are produced in 66 standard sizes and in custom-engineered models. The bulletin also explains how to determine pumping head, carries tables of available sizes, approximate dimensions and head capacities, and tabulates friction loss for water per 100 ft. of pipe. *Allis-Chalmers Mfg. Co., 1124 S. 70th St., Milwaukee, Wisc.*

Plastic houseware catalog—The firm's complete line of plastic housewares—45 items—is presented in this 1953 catalog, printed in full color. *The Plas-Tex Corp., 2525 Military Ave., Los Angeles 64, Calif.*

Diatomaceous silica products—The geological origins of diatomite deposits, and present-day uses in modern industry are told in a 28-page booklet entitled "Celite—The Story of Diatomite." After mining and proper processing, the material extracted from these deposits finds wide industrial applications. In the field of plastics, it imparts an attrac-

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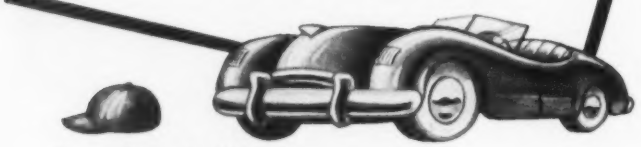

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tive and durable finish when used as a filler in phenol formaldehyde molding powders. It also is reported to improve electrical properties, strength, toughness, and resistance to heat and moisture. Finally, it is said to help provide better molding flow and shorten curing time. *Johns-Manville, 22 E. 40th St., New York 16, N. Y.*

Teflon and Rulon—A four-page brochure and three data sheets give property data and application information on Teflon, Du Pont's tetrafluoroethylene resin, and Rulon, a bearing material requiring no lubrication. Also described are the results of mixing Teflon with filler materials. *Dixon Saddle Co., P. O. Drawer 7, Bristol, R. I.*

Honeycomb—Detailed technical information and application notes on aluminum, fibrous glass, stainless steel, and cotton fabric honeycomb cores for sandwich construction are presented in this 32-page brochure. It describes how permeable aluminum honeycomb allows passage of solvent vapor or air, eliminating distortion; it provides basic information on stainless steel honeycombs designed for use at a temperature range from 350 to 1000° F.; and it points out the weight advantages of using fibrous glass honeycomb structures. Photographs, tables, and charts giving properties and weight and strength factors of the various honeycombs are included. *Hexcel Products Co., 955 61st St., Oakland 8, Calif.*

Plate magnet—Illustrated with photographs and engineering drawings, Bulletin B-603 lists specifications, installation notes, and suggested uses for permanent, non-electric, Alnico V plate magnets in the removal of harmful tramp iron and other ferrous particles from material in-process. Such removal eliminates the danger of fire or explosion caused by iron sparks, reduces machinery down time, and increases product quality. These magnets are guaranteed for the life of the equipment on which they are installed. Tramp iron collected by the magnets is removed from them manually. The magnets are built in units from 4 to 24 in., but are available for any width installation. For instance, to protect an 80-in. wide

chute, four separate units, each 20 in. wide, would be installed. *Eriez Mfg. Co., Erie, Pa.*

Terminology—Definitions of terms used in cost accounting, time study, wage planning and administration, arbitration, methods of engineering, sales planning, and personnel practices—compiled by 93 management leaders over a period of four years—have been published in "A Glossary of Terms Used in Methods, Time Study, and Wage Incentives." Each of the 332 terms and expressions in the Glossary is defined on the basis of its interpretation by the greatest number of experienced people using them professionally and successfully. The glossary aims at cutting down wrangling, aimless discussion, and hair-splitting interpretations over contract language. Price $1.00 per copy. *Society for Advancement of Management, 411 Fifth Ave., New York 16, N. Y.*

Test instruments—A listing of the company's more than 100 testing instruments for the paint and oil industries is given in its 1953 catalog. Instruments included are for the measurement of viscosity of oils, varnishes, and similar products; for the determination of wet film thickness of paint, lacquer, and related compounds; for ascertaining drying time of paints; for measuring resistance to abrasion as well as washability of varnishes, waxes, etc.; and for indicating gloss characteristics of various petroleum products. Price list is included. *Gardner Laboratory, Inc., 4723 Elm St., Bethesda 14, Md.*

Creped kraft—"The Story of Two Knives" is a Cindus X-Crepe history of packaging problems solved in such diversified fields as food, cigarettes, appliances, and others. The booklet illustrates how the company's creped and cross-creped kraft product, in addition to its packaging applications, can also be used in place of cloth, rubber, cork, and other materials; and how it can be coated, impregnated, and laminated with cloth, fibers, films, foils, or other layers of X-crepe to impart special qualities. *Cincinnati Industries, Inc., Cincinnati 15 (Lockland), Ohio.*

Anti-adhesive coating—As an aid to cleanliness of glue pots and adjoining machinery, a new solvent dis-

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persion coating material is introduced and described in this 4-page leaflet. Brushed on glue pot or machinery, the coating prevents hardening of adhesives and thus facilitates their removal from the protected parts. The coating is effective for resin and latex adhesives, as well as for animal and vegetable glues. The new release agent is available in pint, quart, and gallon containers. *Federal Adhesives Corp., 210 Wythe Ave., Brooklyn 11, N. Y.*

Acetylene derivatives—Bulletin M-104 describes the structures, physical form, availability, and suggested uses of a selected series of high pressure acetylene derivatives. The various compounds included have such industrial applications as chemical intermediates, solvents, plasticizers, pharmaceuticals, brake fluids, cosmetic components, and others. *Commercial Development Dept., General Aniline & Film Corp., 435 Hudson St., New York 14, N. Y.*

Industrial chemicals—Seven classes of industrial chemicals, their physical and chemical properties and their uses, are listed in this 8-page catalog. The chemical groups included are sorbitol, surfactants, mannitol, solid polyester resins, fatty acids, plasticizers, and activated carbons. For each of these compound families a description of properties is given, followed by a discussion of the different applications for which they are useful. *Atlas Powder Co., Wilmington 99, Del.*

Safety posters—A 72-page directory contains 756 miniature illustrations of occupational safety posters designed to aid in the maintenance of high levels of industrial safety. Both serious and humorous approaches are used to enable the industrial safety director to select the soundest psychological approach to his particular problem. Poster subjects were selected on the basis of latest occupational accident statistics. Many of the posters pertain to specific industries but there is also a wide selection of general themes applicable to virtually all industrial fields. The directory includes a section on how to select and display posters for best results. Single-copy as well as quantity prices are listed for each poster. *National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.*

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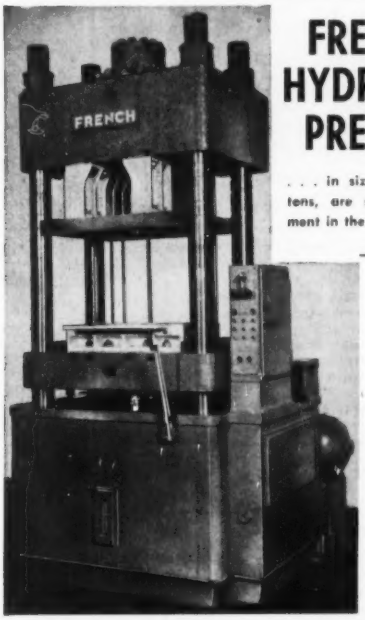

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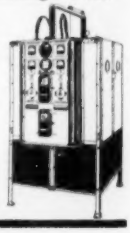

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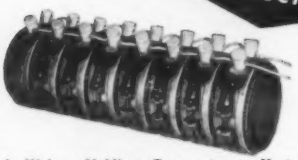

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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTIC AND SYNTHETIC RESIN PRODUCTION IN
From Statistics Compiled

Materials	*Total p'd'n. first 2 mos. 1953*	*Total sales first 2 mos. 1953*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester plastics:		
Sheets, under 0.003 gage	2,288,947	2,409,173
0.003 gage and over	1,765,709	1,737,022
All other sheets, rods and tubes	879,984	763,258
Molding, extrusion materials	12,198,993	12,133,307
Nitrocellulose:		
Sheets	1,100,427	975,769
Rods and tubes	102,375	131,434
Other cellulose plastics[b]	1,053,122	1,156,029
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	13,324,744	9,008,536
Adhesive	8,211,769	7,684,737
Molding and casting materials[a]	33,145,082	36,205,728
Protective coatings (modified and unmodified except by rosin)	5,026,604	4,579,106
Miscellaneous uses	13,598,279	12,661,120
UREA AND MELAMINE RESINS:		
Adhesives	11,196,635	10,848,123
Textile-treating resins	5,911,699	6,223,500
Paper-treating resins	4,148,083	3,931,971
Protective coatings, modified and unmodified	5,255,931	3,946,847
Miscellaneous uses, including laminating and molding[c]	12,601,030	13,428,893
STYRENE RESINS:		
Molding materials[a]	53,111,968	50,967,473
Protective coatings, modified and unmodified	13,266,931	13,594,309
Miscellaneous uses	14,199,352	12,419,237
VINYL RESINS:[d] Total	85,533,581	83,913,578
Sheeting and film (resin content)[e]		31,346,562
Adhesives (resin content)		3,877,509
Textile and paper-treating resins (resin content)[f]		8,429,282
Molding and extrusion materials (resin content)		29,270,554
Protective coatings (resin content)		4,994,136
Miscellaneous uses (resin content)		5,995,535
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS:	29,303,161	28,989,599
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS:		
Molding materials[a,g]	21,510,621	19,313,514
Protective coatings[h]	1,300,401	856,282
All other uses[i]	21,802,462	22,021,426

[a] Dry basis is designated unless otherwise specified. [b] Includes fillers, plasticizers, and extenders. [c] Includes sheets, rods, and tubes, and molding and extrusion materials. [d] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [e] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total produc-

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

POUNDS[a] FOR JANUARY AND FEBRUARY 1953 by U. S. Tariff Commission

January 1953		*February 1953*	
Production	*Sales*	*Production*	*Sales*
1,021,932	1,216,481	1,267,015	1,192,692
825,491	781,863	940,218	955,159
512,534	360,080	367,450	403,178
5,991,958	6,222,809	6,207,035	5,910,498
553,310	507,341	547,117	468,428
56,244	76,393	46,131	55,041
532,461	618,706	520,661	537,323
7,107,340	4,815,532	6,217,404	4,193,004
4,077,163	3,734,013	4,134,606	3,950,724
17,111,429	19,264,988	16,033,653	16,940,740
2,554,777	2,174,087	2,471,827	2,405,019
7,009,342	6,663,067	6,588,937	5,998,053
5,405,080	4,727,844	5,791,555	6,120,279
2,971,322	3,207,993	2,940,377	3,015,507
2,093,750	1,973,201	2,054,333	1,958,770
2,534,063	1,919,804	2,721,868	2,027,043
7,412,641	6,541,341	5,188,389	6,887,552
25,842,559	24,445,418	27,269,409	26,522,055
6,942,728	7,003,170	6,324,203	6,591,139
7,095,157	6,409,390	7,104,195	6,009,847
44,505,893	41,990,779	41,027,688	41,922,799
	14,830,282		16,516,280
	1,986,772		1,890,737
	4,283,852		4,145,430
	15,423,806		13,846,748
	2,389,961		2,604,175
	3,076,106		2,919,429
14,378,100	14,693,761	14,925,061	14,295,838
10,729,217	9,648,620	10,781,404	9,664,894
679,542	390,569	620,859	465,713
11,058,475	11,233,916	10,743,987	10,787,510

tion are given. [e] Prior to January 1951, statistics were given on the basis of total weight. [f] Includes data for spreader and calendering-type resins. [g] Includes data for acrylic, polyethylene, nylon, and others. [h] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. [i] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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ENGRAVE your own NAMEPLATES
DIALS • PANELS

The fastest, easiest method for engraving individual nameplates, dials and panels.

- Automatic depth regulator.
- Engraves 15 sizes from One master alphabet.
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NEW HERMES, Inc. 13-19 University Place, N.Y. 3
In Canada: 359 St. James St., Montreal
World's Largest Manufacturer of Portable Engraving Machines

Have you considered PERFORATED PLASTICS for
★ Ventilation
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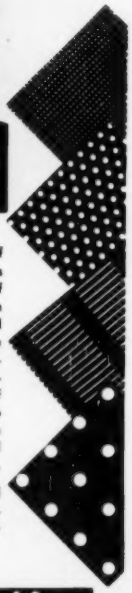


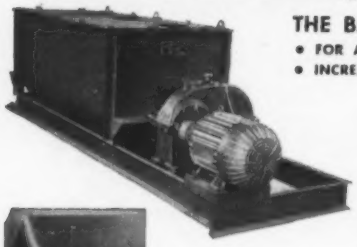
We have made the perforating of plastics one of our specialties. This specialty is supported by 70 years of perforating experience, during which time we have acquired an unlimited selection of patterns from which you may choose. Perforations range upward in hole sizes from 1/50" diameter, with practically any spacing of holes you may require. In addition to plastics, we can also perforate such materials as metal, paper, vulcanized fibre, hardboard, coated fabrics, etc.

Submit your specifications for material and size, shape and spacing of Perforations—or a description of your needs so we may recommend.

We invite you to consult our engineering department for recommendations. Send for our Booklet "Samples of H & K Perforated."

The Harrington & King Perforating Co
5680 Fillmore Street, Chicago 44, Illinois
114 Liberty Street, New York 6, New York

REDUCE PRODUCTION COSTS with R.N. Bailey MACHINES!



THE BAILEY MIXER

- FOR A BETTER MIXING JOB—
- INCREASED PRODUCTION

THE BAILEY MIXER ELIMINATES SOLIDIFYING ON HOT SURFACES! Now—you can pre-mix before loading into your Banbury or calender—shortening cycle time—increasing production and boosting efficiency all along the line.

Here is up-to-the-minute construction with the very latest improvements in details. More efficient cleaning—empties quicker—more thoroughly—more basic body support—new mixing element—increased mixing intensity.

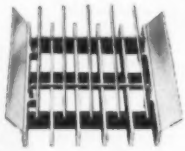
Write now for full details and the many reasons why such companies as Monsanto, American Cyanamid, Borden, Ross & Roberts, Resiloid, Ideal Plastics, Armstrong Rubber, and others—all use Bailey Mixers! We have a complete line of scrap preparation equipment including sifters, cutters, shredders, batch dumpers, and others.

ROUNDED CORNERS for quicker—more complete cleaning to assure pure dyes every time!

MAGNETIC GRATE SEPARATOR

PREVENTS UNNECESSARY DAMAGE TO EQUIPMENT

The Magnetic Grate consists of highly saturated Alnico No. 6 magnets and intervening steel bars.
Placed in the throat of the hopper, the grate attracts every ferrous object from material being loaded in machine. Retaining this and all other large debris of all kinds—rags, sticks, stones, paper, strings, and other foreign objects, it helps prevent damage to expensive machinery.
The grate can readily be lifted out for removal of tramp iron and debris. Magnets are of permanent type. They are always in operation because no one can turn the magnetic force on or off. It is always constant. The Magnetic Grates are available in sizes from 2"x4" up to 8 feet square. Grates of virtually any size or shape can be furnished to meet unusual requirements.



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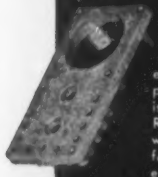
PRIME CONTRACTORS SEE "ACCURATE" FOR MILITARY COMPONENTS

The manufacture of molded plastics for devices for military requirements is one of our specialties . . . thousands of military parts are in present production.



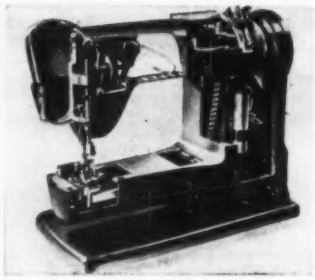
Considerate and experienced handling of your plastic molding problems is available thru ACCURATE SERVICE where you will find ample, modern facilities to meet your every plastic molding requirement . . . at MAXIMUM efficiency and economy.

INJECTION COMPRESSION MOLD IT BETTER FASTER PLUNGER TRANSFER

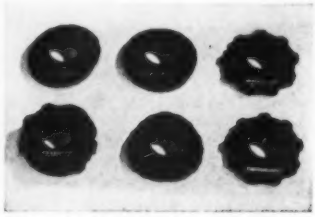
SEND your specifications NOW! We invite your toughest problems. . . . . NO OBLIGATION

SPECIALISTS IN SMALL RUNS USING HAND MOLDS

ACCURATE MOLDING CORPORATION 35-10 48th AVENUE LONG ISLAND CITY 1, N.Y.



Sewing machine (cross-section, above) is controlled by phenolic slip-on disks



Each molded phenolic disk is shaped to reproduce a different stitch pattern

For Sewing Fancy Stitches

BY USING a unique system of black phenolic slip-on disks, a new portable sewing machine distributed by Elna Sewing Machine Co., Inc., New York, N. Y. completely eliminates the guesswork and difficulties involved in sewing decorative stitches.

Each of the more than 100 disks available are approximately the size of a half-dollar and are molded in different shapes representing a variety of stitch designs that range from simple straight stitches to elaborate ornamental stitches.

To operate the machine, the particular disk desired is easily inserted into the compact "brain" built into the upper right hand section of the body and is fastened in place with a screwed-on nut. As power is applied and the disk revolves, a cam arrangement transfers the curves and indentations of the disk into movements of the needle and the pattern is repeated on the fabric.

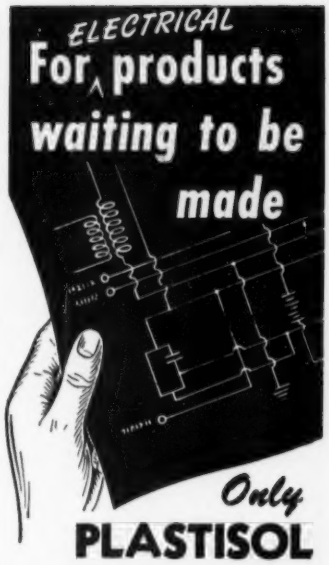
For easier identification, a number is embossed on one side of the disk and the stitch pattern it will sew is painted in white on the other.

Imports and Exports

Volume of Plastics and Raw Materials Used in the Plastics Industry[a]

	1950	1951	1952	Country[b]
	IMPORTS (In pounds unless otherwise stated)			
Benzene (gal.)	23,000,000	68,500,000	43,700,000	U. K.
Cresylic acid (gal.)	3,500,000	4,000,000	1,200,000	U. K.
Napthalene, solidifies at under 79° F.	110,800,000	73,500,000	92,100,000	W. Germany
Napthalene, solidifies at over 79° F.	1,400,000	3,400,000	500,000	Netherlands
Hexamethylene tetramine	20,000	700,000	42,800	U. K.
Cresols, all types	1,900,000	912,000	275,000	U. K.
Phenol	154,000	4,000	17,000	W. Germany
Phthalic anhydride	1,400,000	200,000	232,000	Japan
Coal tar styrene	[c]	[c]	401,000	Canada
Phenolic resins	416,000	165,000	1,454,000	Canada
Vinyl acetate, unpolymerized	3,800,000	7,900,000	11,500,000	Canada
Vinyl acetate, polymerized	331,000	3,600,000	1,200,000	Italy
Cellulose acetate sheets	80,700	162,500	98,800	U. K.
Cellulose acetate blocks, rods, etc.	133,300	415,500	90,700	France
Acrylic resins, rods, etc.	[c]	[c]	140,000	U. K.
Cellulose nitrate sheets 0.003 to 0.0032 inch	1,100	23,300	537	U. K.
Cellulose nitrate in other forms	450	2,500	1,200	Sweden
Sodium Cyanide	91,600,000	137,800,000	133,600,000	Canada
Synthetic gums and resins not otherwise specified[c]	373,000	156,000	70,000	U. K.
	EXPORTS			
Benzol (gal.)	1,300,000	336,000	200,000	Canada
Napthalene (crude and refined)	61,700	679,000	248,000	Canada
Phenol or carbolic acid	14,000,000	21,000,000	22,300,000	Canada
Cresylic acids and cresols	3,000,000	5,000,000	4,200,000	Chile
Phthalic anhydride	2,800,000	9,200,000	3,900,000	Canada
Phthalic anhydride resins unfinished	[c]	[c]	7,700,000	Canada
Phthalate esters dibutyl	164,500	1,400,000	1,000,000	France
Phthalate esters, others	808,000	7,300,000	2,600,000	Canada
Phthalate esters dioctyl	[c]	[c]	4,100,000	France
Formaldehyde, 40% solution	24,000,000	28,900,000	28,600,000	Canada
Polystyrene[d]	26,500,000	26,600,000	14,000,000	India
Styrene molding, 60% or more styrene	[c]	[c]	1,300,000	Sweden
Styrene resins 60% or more styrene unfinished	[c]	[c]	9,500,000	Canada
Maleic anhydride resins	[c]	[c]	3,200,000	Canada
Vinyl resins, including film, sheet and compound	31,600,000	42,300,000	[c]	[c]
Vinyl chloride resins, powder flake, etc.	[c]	[c]	11,500,000	Canada
Vinyl chloride compounds	[c]	[c]	3,800,000	Brazil
Vinyl film & sheeting	[c]	[c]	13,000,000	Canada
Vinyl chloride resins unfinished	[c]	[c]	700,000	Canada
Vinyl resins scrap	[c]	[c]	2,000,000	Italy
Vinyl resins, others	[c]	[c]	4,300,000	Canada
Urea and melamine	11,900,000	17,350,000	12,500,000	Canada
Phenol and cresol laminated sheets	[c]	[c]	1,200,000	Canada
Laminated and molded laminated plastics	[c]	[c]	1,100,000	Canada
Cellulose ethers and shapes therefrom	[c]	[c]	900,000	U. K.
Cellulose nitrate scrap	639,000	611,600	395,000	Mexico
Cellulose nitrate film, sheets, rods, etc.	5,000,000	870,000	351,000	Canada
Cellulose acetate molding composition	5,779,000	6,600,000	3,000,000	France
Cellulose acetate film and sheets	950,000	9,000,000	9,700,000	U. K.
Cellulose acetate scrap	230,000	3,300,000	352,000	Italy
Vulcanized fiber sheets, etc.	5,900,000,	9,483,000	6,800,000	U. K.

[a] Source: United States Imports and Exports of Merchandise for Consumption, by Bureau of Census.
[b] Name of country indicates leading importer or exporter for commodity listed.
[c] This figure includes acrylic, polyethylene, silicone, urea and melamine, non-coal tar alkyds, and vinyls, except vinyl acetate for 1950 and 1951. In 1952, the acrylics are given separately.
[d] Polystyrene was listed as polymer and copolymer combined in 1951 and 1952.
[e] Blank spaces indicate that figures are not available, not understandable, or that figures for the particular commodity mentioned have been separated into their various categories in 1952 instead of being given in a lump sum as in previous years.



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PLASTISOL INSULATION
for Molding, Extruding or Dipping can be specifically compounded to produce these advantages:

- Ease of molding or coating—inexpensive molds or equipment required
- Good aging properties under normal operating temperatures
- Low temperature flexibility
- Good outdoor durability
- Resists most acids and alkalis
- Good flame resistance
- Resistance to oil and grease

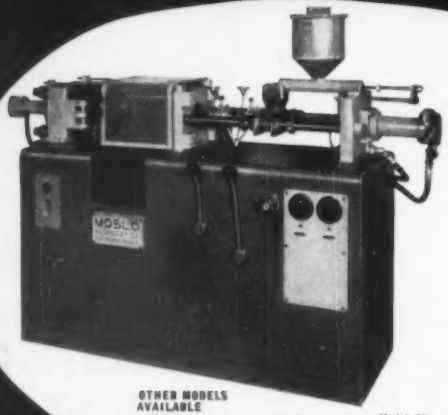
Whatever you manufacture, from spaghetti wiring to circuit-breaker panels, Stanley chemists can formulate a vinyl plastisol to meet your most exacting insulation requirements. For specific information write *today* to the Stanley Chemical Co., 72 Berlin St., East Berlin, Conn.

Industrial Coatings
STANLEY CHEMICAL
LACQUERS JAPANS SYNTHETICS ENAMELS

Announcing THE ALL NEW

MOSLO ONE OUNCE MOLDING MACHINE

MODEL NO. 71



OTHER MODELS AVAILABLE

HC 75	Duplimatic	Model 72
¾ ounce	2½ ounce	2 ounce automatic and repeat

Here at last is the answer for a revolutionary one ounce plastic molding machine. Moslo engineers have carefully designed and built this horizontal, all hydraulic machine to meet the most rigid requirements for the custom molding of small parts. This Model No. 71 machine is built of the finest materials to provide years of satisfactory performance. Here are some of the outstanding features of this machine.

- Four tie rod construction
- Direct four-point double toggle
- 32 ton clamping pressure
- Safety gate protects the mold
- 1250 PSI maximum pressure on material cylinder ton oill is 10,200 pounds
- Automatic feed
- Injection piston is water cooled
- Chrome plated plasticizing cylinder, nozzle and spreader
- 12 pounds per hour plasticizing capacity
- Equipped with automatic knock-out rods
- Heat controlled by two Cramer heat percentage timers
- Accommodates 8 x 9 DME mold blanks and others
- Pump equipment is by Vickers
- Hydraulic operation is manually controlled

We invite your inquiry. Write for additional information

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M&M PLASTIC PELLETERS

M & M Plastic Pelleters will produce clean cut plastic pellets that need no screening when cutting the product from extruder or compounding mill. A variable speed drive permits the Pelleter to be synchronized with the extruder or mill output. The M & M straight knife Plastic Pelleter will cut extruded plastic rods into pellets of uniform size and shape. The M & M notched knife pelleter will produce pellets of uniform size in a hexagonal shape from plastic ribbons up to 10" wide.
Write us about your needs today.

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..the encyclopedic "guide to buying"

T. R. provides more accurate and complete "where-to-buy" information and purchasing data than all other sources combined. 10,384 Advertisers use 38,943 advertisements in the 1953 Edition.

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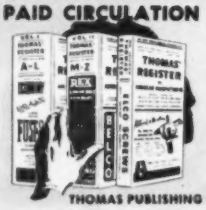

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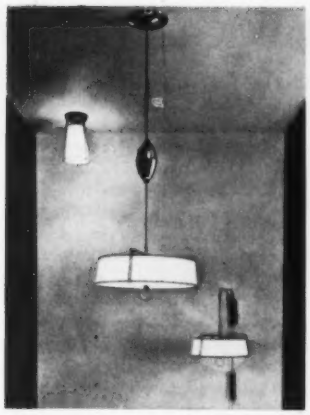


Permanently installed lighting fixtures use decorative vinyl laminate shades

Vinyl Shades

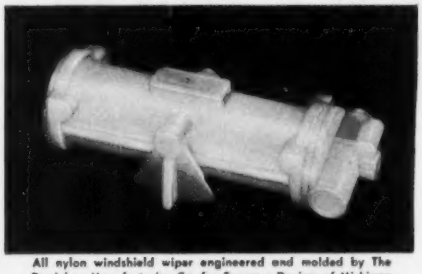
FUNCTIONALISM, flexibility, and clean, smart lines characterize the application of a vinyl laminate shade used for permanently installed lighting fixtures.

Designed for a modern decor, each of the fixtures in the collection by Lightolier, Inc., New York, N. Y. is supplied with a matching shade consisting of an attractive, loosely woven linen-like material laminated between two sheets of translucent vinyl. The fixtures are particularly suited for small rooms, since the over-all diffusion of light through the vinyl laminate shades tends to make low ceilings look higher and small rooms look larger.

The vinyl laminate, which is a product of Pan Laminates, Inc., New York, N. Y., also serves to cut down glare to a soft, even glow. The durable vinyl shades will resist tearing, warping, fading, shrinking, abrasion, and scuffing. They are unaffected by moisture, mildew, mold, greases, and most chemicals, and can be wiped clean with nothing more than a damp cloth.

Included in the collection of multi-duty lighting fixtures are two ceiling fixtures, which glide up and down on a concealed spring-triggered reel; snug-to-ceiling fixtures in round, square, or rectangular shapes; and a pin-up model fixture which raises or lowers, swings from side to side, and can be plugged in like a lamp.

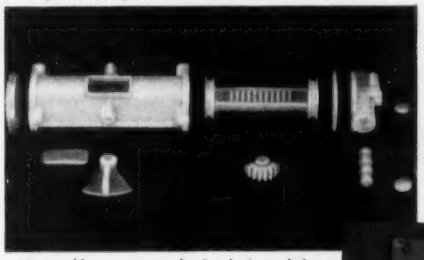
WHEN IT COMES TO MOLDS FOR PLASTICS—



All nylon windshield wiper engineered and molded by The Danielson Manufacturing Co. for Sprague Devices of Michigan City, Indiana, represents a milestone in industrial development.

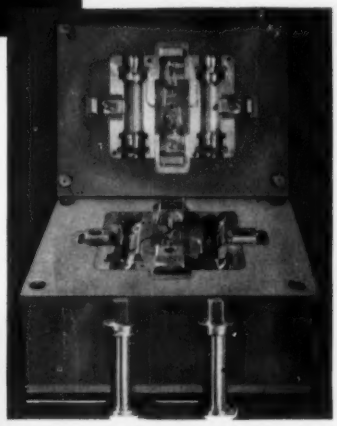
P IS FOR Parker

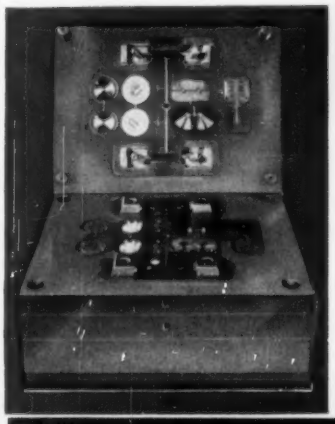
REVOLUTIONARY WINDSHIELD WIPER PRECISION MOLDED OF DUPONT NYLON FROM MOLDS DESIGNED AND BUILT BY PARKER.



11 assembly components showing intricate design. Molded to machined tolerances—each identical, each ready to assemble into a superior functional unit.

PROBLEM: Devise a windshield wiper lighter than aluminum, more durable than steel . . . for Army vehicles and heavy trucks. Each component must be quickly, economically produced—all must fit to machined tolerances for lasting performance under exacting conditions.





SOLUTION: A 100% nylon assembly produced from an 18 and a 4 cavity mold by Parker. Components for complete assemblies are turned out in seconds with each part so clean, so free from flash that machining has been eliminated — tolerances reduced to virtually zero. Another outstanding example of the ingenuity and cooperative engineering available at Parker.

Investigate the Flexibility of Parker's Facilities
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PLASTIC MOLD DIVISION
FRANKLIN AVENUE • HARTFORD, CONNECTICUT

Cold Mold
Plunger
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Transfer
only
PLASTIC MOLDING CORP.
offers
5
all
major
molding
methods

Our many customers find it a distinct comfort to know that Plastic Molding Corp. molds by *all five major molding methods.*

To them this means we always consider their molding assignments in terms of *what is best,* not in terms of *what equipment we have* . . . because we have every type of press equipment for molding plastics . . . the *one* molder in New England who offers you *all five major molding methods.*

PLASTIC MOLDING CORPORATION
SANDY HOOK, CONNECTICUT

Molders of Plastics for over a Quarter Century

S.P.I. Bermuda Conference

AT the annual conference of the Society of the Plastics Industry held aboard the liner *Queen of Bermuda* May 10 to May 14, the following society officers were elected for the ensuing year: Chairman of the Board, Gordon Brown, Bakelite Co., Div. Union Carbide & Carbon Corp., New York; President, John J. O'Connell, Consolidated Molded Products Corp., Scranton, Pa.; Vice President, Earl R. Keown, Santay Corp., Chicago, Ill., Secretary-Treasurer, Frank E. Selz, General American Transportation Corp., Chicago.

Directors were elected for one year as follows: C. M. Adams, The Electric Auto-Lite Co., Bay City, Mich.; H. Paul Cleaver, The Fuller Brush Co., Hartford, Conn.; J. P. Coe, Naugatuck Chemical Div., U.S. Rubber Co., New York, N.Y.; T. K. Cramer, Plastene Corp., Crawfordsville, Ind.; Harold B. Freeman, American Cyanamid Co., New York, N.Y.; George V. Goulder, International Molded Plastics, Inc., Cleveland, Ohio; William Hess, Anesite Co., Chicago, Ill.; Lionel B. Kavanagh, Standard Tool Co., Leominster, Mass.; C. Russell Mahaney, Panelyte Div., St. Regis Paper Co., New York, N.Y.; Bernard Mittman, Elm Coated Fabrics Co., New York, N.Y.; Frank Parizek, Frank Parizek Mfg. Co., Putnam, Conn.; N.J. Rakas, National Automotive Fibres, Inc., Detroit, Mich.; G. Murray Scott, Dow Chemical of Canada, Ltd., Toronto, Canada; T. F. Stacy, French Oil Mill Machinery Co., Piqua, Ohio; Leslie M. Swanson, Electrical Specialties Co., Los Angeles, Calif.; and G. G. Welch, The Watertown Manufacturing Co., Watertown, Conn.

General chairman of the conference was Bernard Schiller, Banner Plastics Corp., Paterson, N.J. Under the chairmanship of William H. Nussbaum, C.P.A., a panel made up of the following executives discussed management problems such as wage incentives, statistical quality control, and depreciation rates: F. Reed Estabrook, Jr., Northern Industrial Chemical Co.; Dale Amos, Amos Molded Plastics Div.; Elmer E. Mills, Elmer E. Mills Corp.; James B. Neal, Norton Laboratories, Inc.; Victor G. Reiling, Kurz-Kasch, Inc.; John J. O'Connell.

In his report as retiring president, Gordon Brown discussed the vast expansions under way in plastics.

Under the chairmanship of Gordon C. Brown, Irvington Varnish & Insulator Co., three speakers presented the latest information on the fields closest to their interests. Roger B. White, The Glastic Corp.—"The Reinforced Plastics Industry;" George A. Fowles, The B. F. Goodrich Chemical Co.—"The Future of Molded and Fabricated Vinyls;" O. H. Yoxsimer, Westinghouse Electric Corp.—"Plastics in the Refrigeration Industry."

With Bakelite's Gordon Brown again presiding, Captain Leslie F. Banyard of the *Queen of Bermuda,* presented the John Wesley Hyatt Award to Dr. Bender (see p. 85).

The incoming president, J. J. O'Connell, presided over a two-session program which featured Jack Lacy, sales training expert.

NEW S.P.I. BOARD CHAIRMAN AND PRESIDENT

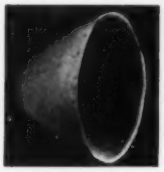
Gordon Brown

John J. O'Connell

It's HEXCEL HONEYCOMB in the F86D!

Hexcel GLASS FABRIC Honeycomb PRE-SHAPED to speed fabrication!

TAPERED-CUT to give optimum radar transmission!



Thirteen pre-curved "orange peel" sections and one nosepiece are furnished for each radome in production of North American Aviation's great F86D All-Weather Interceptor. Pieces are ready for immediate layup when received by fabricator. Waste trim is eliminated.

Hexcel ALUMINUM Honeycomb used in trailing edges, access doors and other parts on F86D!

Now available in ⅛" CELL SIZE giving substantially 100% bond area.

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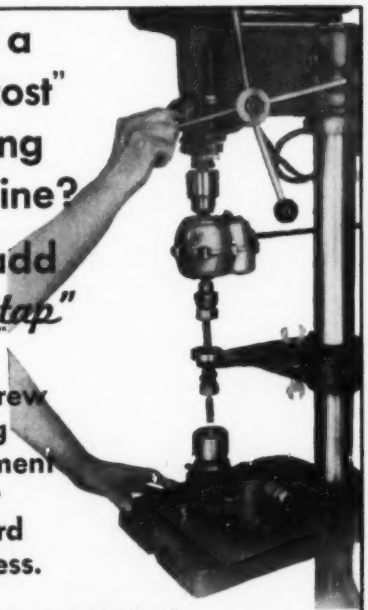
STRUCTURAL HONEYCOMB in ALUMINUM GLASS FABRIC • COTTON FABRIC

North American Aviation Company's F-86D Sabre Jet All-Weather Interceptor, designed expressly for radar interception and firing of the new 2.75 "Mighty Mouse" Aerial Rocket.

Photograph courtesy of North American Aviation Company.

Want a "low cost" tapping machine?

Just add "Auto-tap" TRADE MARK the lead screw tapping attachment to your standard drill press.



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Toy Typewriter

THE fascination of children for typewriters and typing finds an outlet in a new toy model, realistically molded of Dow's 475 high-impact styrene.

The authentic typewriter is a product of Tigrett Enterprises, Chicago, Ill. Although actually only a stamp pad set, the typewriter incorporates the same parts as the standard portable from which it was molded—a flocked roller that really operates; keys with raised numerals or letters; a letter guide; and a space bar that covers a small compartment for storing pencils, pens, erasers, etc.

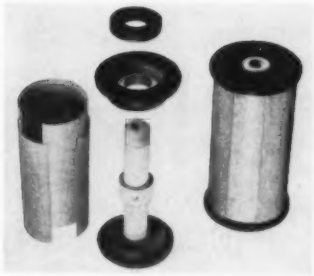
To use the unit, the young typist merely pulls the key with the proper letter on it from the keyboard and touches it to the built-in ink pad directly under the roller. The inked letter is then pressed through slots in the letter guide and onto the paper.

The one-piece shell of the typewriter and all the other parts, with the exception of the keys, are molded in a 3-cavity mold in a 32-oz. machine. The keys are also molded in a 3-cavity mold.

The entire unit can be quickly assembled in a matter of minutes. The only cementing that has to be done is on the two separately molded halves of the roller. The finished roller is then flocked to provide better adhesion for the paper. Slots and cavities at either end—top and bottom—of the typewriter permit the roller, letter guide, and space bar to be easily snap-fitted into place.

Bright red and yellow and green and gray are available as the color combinations.

Body and parts (right) of toy typewriter (left) are molded of styrene



Parts (left) of collapsible bobbin (right) are made of phenolic laminate

Laminate Bobbin

FABRICATED of phenolic-impregnated laminate, new collapsible bobbins, are designed to reduce the costs of pre-shrinking nylon yarn by about 80 percent.

Previous to the adaptation of the plastic bobbin, which was perfected by Synthane Corp., Textile Div., Oaks, Pa., a major problem in handling nylon yarn was the tendency of unprocessed material to shrink as much as 11% during heat treatment. At the same time, conventional shrinking methods resulted in a substantial variation in residual shrinkage between yarn on the inside and the yarn found on the outside of the package.

By using the collapsible bobbin, this residual shrinkage differential is held constant within ½ of 1% or less throughout the package. The ability of the bobbin to collapse as the yarn demands, eliminates several of the pre-shrinking steps and many of the restrictions that had previously resulted in high processing costs.

The bobbin consists of two concentric, cylindrical tubes. A segment is cut off lengthwise from each tube, leaving a space which, as the yarn shrinks, allows the tube to reduce in diameter sufficiently to accommodate the yarn.

The barrel assembly of the bobbin is made of a paper-based laminate for extra smoothness and the heads of the barrel are machined from a rugged cloth-based laminate to minimize breakage from rough handling. The only steel parts of the bobbin are a flat spring attached to the inside of the inner tube to resist compression; a screw; and a washer.

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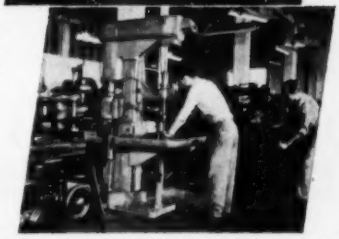

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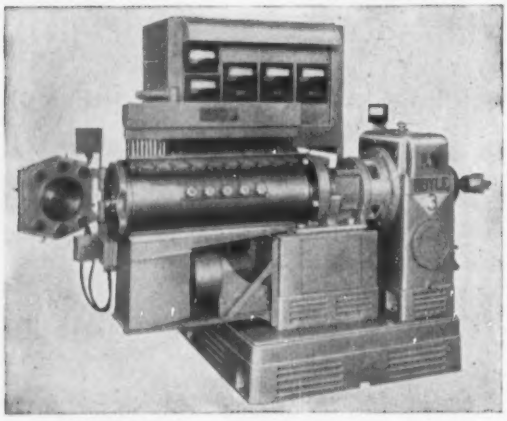

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Body of model lift truck is molded of styrene; wheels and carriage are acetate

Scale Model

A MINIATURE working model, molded of plastics, has been introduced by Towmotor Corp., Cleveland, Ohio, as a scaled-down replica of their industrial fork lift truck.

Designed to the $\frac{1}{16}$ scale standard for precision-engineered models, the miniature captures in intricate detail the basic operating features of the actual truck. Moving a tiny gear shift lever tilts the telescopic mast to various angles; pushing a lever that projects slightly from the rear of the model raises and lowers the two forks at the front of the truck. The attractive, bright coloring of the plastics parts also authentically duplicates the standard colors of the full-size truck.

The replica, measuring only 5 in. high when the mast is lowered and 8 in. long from the rear of the truck to the tip of the fork, is sturdily constructed of styrene and acetate to withstand rough handling. The main body of the truck, including instrument panel and rear deck, is injection molded in one piece by Majestic Molding Co., Elyria, Ohio, using both red and black Dow 475 styrene. A third color, gray, is obtained by painting where necessary. Wheels, carriage, and the simulated hydraulic cylinder are also molded by Majestic Molding Co., using Tenite I cellulose acetate. Additional parts—telescopic masts, forks, and linkage—are made of steel. Scaled rubber tires are applied to the molded acetate wheels for added realism.

Intended originally as a sales device, the model has now been made available as an appealing toy for children or to complete the collection of the gadgeteer.

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Film Illuminator

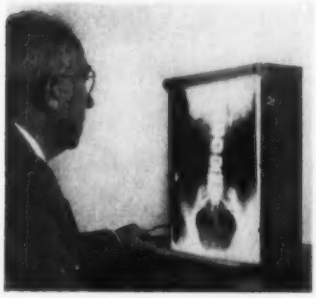
THE excellent light-diffusing characteristics of acrylic, the ease with which it can be formed and machined, and its resistance to chemical attack are utilized to advantage in a recently announced Plexiglas illuminating screen for viewing X-ray films.

The illuminator unit, consisting of the screen mounted in a metal box, is made by Roland J. Gaupel Co., Los Angeles, Calif.

To eliminate the need for separate metal frames and film clips that might rust when wet film is viewed, the entire front of the illuminator is formed as a one-piece panel. This panel consists of the screen, a shallow drip pan formed at the bottom edge of the screen, and a channel made by rolling the top edge of the screen. Inserted in this channel are a series of small glass balls. When the illuminator is in use, the X-ray film is slipped into the channel and held in place by the pressure of the glass balls, but is easily removed.

In fulfilling the rigid requirements necessary for diagnostic study of X-ray film, the translucent acrylic screen exhibits a notably high degree of light transmission combined with uniform diffusion. It is also completely resistant to the corrosive solutions used in developing and fixing X-ray film. During one test, designed to determine the extent of this resistance, solutions were applied to a test panel and allowed to remain on it for two weeks until they had evaporated. No stains or damaged areas were found on the panel at the end of this time.

Panel for X-ray film viewer is formed of one piece of translucent acrylic



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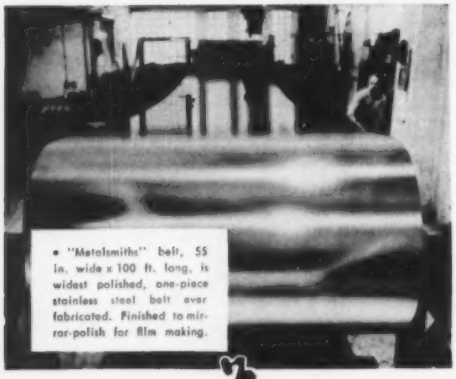

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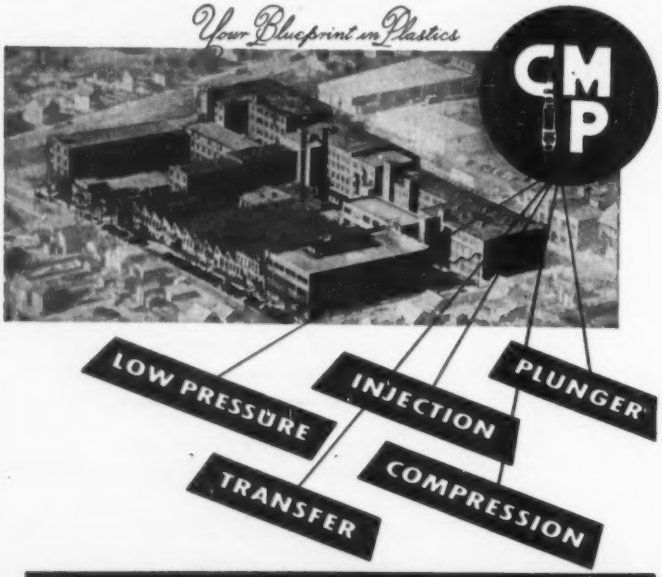

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Canopies

(*Continued from pp. 72-73*)

Forming in the die was done by the familiar method of slip-forming used in forming of sheet metal parts. A female die was constructed, using plaster as a facing material. A highly polished rubber blanket, which followed the contour of the die, but minus about 1½ in. of contacting it, was suspended by the use of stud bolts or pressure pads, in such a manner that it was held in the form of a sling on the inside of the die cavity. The hot sheet, which was now in the shape of a half-cylinder, was laid upon the rubber blanket. A second blanket of highly polished rubber was then laid over the plastic sheet, making a sandwich of rubber, plastic, and rubber. The bottom rubber sheet acts as a back pressure pad to keep the plastic sheet from wrinkling.

The male top, which has an inflatable bag attached to the bottom of the male cover and made to the contour, was then mounted in place and bolted tightly. Compressed air pressure of about 3 p.s.i. was applied to the rubber bag. Through air vent holes in the bottom of the female die, the movement of the plastic sheet may be checked. The object is to keep the plastic sheet moving slowly, allowing it to slip down into the die at a slow and even rate. If the rate of movement is too slow, the pressure must be increased to 5 p.s.i.

At no time must the movement, during the forming operation, come to a complete standstill until it has reached full contour in the die. If it is necessary to increase pressure beyond 5 p.s.i., it is permissible to go up to 7 p.s.i. However, if the sheet does not form and comes to a stop while pressure is at 7 p.s.i., then either the temperature of the sheet is too low to form or the contour of the die is too great.

When the bottom of the die is reached, pressure should immediately be reduced to 1½ p.s.i., or just enough to hold the sheet in position until cool. If the pressure is not released, there may be a tendency to mark-off, with resulting poor optics. Experiments conducted at Lockheed have shown a pressure of 1 to 1½ p.s.i. to be usually sufficient to hold the canopy in con-

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tact with the die face until cool enough for removal.

Trimming and machining of the edges of the formed canopy may be done in the same type of jigs and fixtures, and with the same type of tools used in machining of acrylics. Cutters ground with 90° angle of attack seem to work fairly well. However, other methods of tool grinding may be found to work equally well or better. Cementing operations for attaching edges are similar to those of acrylics, but special cements have been and are being developed which are more adaptable to polyester materials.

Further Development

There is a great need for further development of forming techniques. However, we feel that the preliminary work already accomplished will give the fabricators sufficient information to enable them to develop new methods and to improve present techniques. It may be possible, if proper sealing can be worked out, to use air pressure for the necessary back pressure. If this can be done, a two-way air valve can be used to reduce the back pressure on one side, while at the same time increasing the bag pressure by the same amount. This would give a smooth and even movement to the sheet while forming.

Another field of investigation would be the forming of polyester sheet while in a "B" stage, instead of the present "B-plus" stage of polymerization. This would give greater flexibility, and open up new limits of formability, possibly to the order of 13 to 15 per cent. Converting the formed canopy to the "A" stage could then be done by heat treating after forming.

Work is now being conducted on annealing temperatures which will tend to complete the polymerization stage and to relieve forming and cementing stresses. So far, it has been found that annealing raises the heat deformation point by some ten degrees, or close to that of the more heat resistant acrylics.

Polyester in laminated form offers more advantages than other transparent materials. It can and has been formed. With some necessary improvements to the present forming techniques, it could be on the production lines of tomorrow.

Commercial Craft

(*Continued from pp. 73-74*)

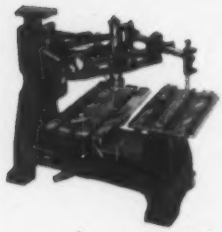
and air conditioning and ventilating ducts.

This reinforced phenolic was chosen because of its good impact resistance, toughness, and heat resistance. About 187 lb. are used in each Convair Liner.

Polyester resin laminates are used as cargo compartment liners, battery containers, wing trailing edge strips, power distribution boxes, oil drip pans, and antenna masts. These materials were chosen for their molding characteristics, abrasion resistance, and electrical characteristics. Each airplane contains about 110 lb. of polyester laminates.

The cotton base post-formed laminates are used for air diffusers, radio rack covers, plenum pans, and pilot's floor scuff plates. About 10 lb. of these laminates are used per ship.

Control pulleys, ranging from 1¼ to 5½ in. in diameter, rubbing strips, cable guides, and electrical panels are made from high pressure cotton base phenolic laminates. The com-



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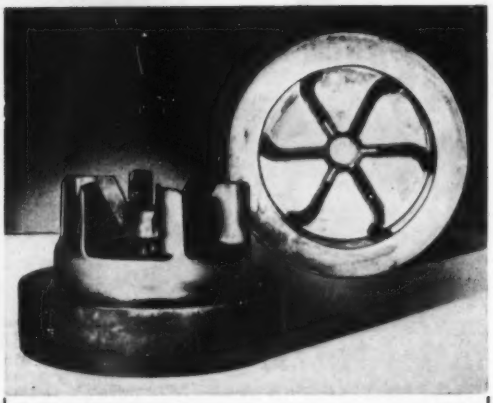

Hob diameter	8½"
Blade height	2.813"
Blade thickness (top)	.062"
Blade thickness (bottom)	.093"
Number of castings required	4
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bined weight of these parts totals about 35 lb. per airplane.

A paper base phenolic laminate is used as a covering for the metal honeycomb floor in the cargo areas. The material is pressed with a grid surface to improve the walking surface. The material is tough and wear resistant, and each Convair Liner has about 15 lb. of it.

All the flooring, partitions, doors, luggage racks, and radio racks are of adhesive bonded honeycomb construction. About 1000 sq. ft. of sandwich panels utilize 110 lb. of phenolic adhesives per airplane.

1000 lb. of Plastics

The total weight of plastics materials in each Convair Liner is about 1000 pounds. Since the empty weight of the airplane is 28,500 lb., plastics materials are 3.5% of the weight of each Convair Liner.

The plastics program was not all easy and trouble-free. The greatest single source of trouble was the matching of colors. Plastics materials were required to match lacquers, natural fabrics, and other plastics. Convair's standards were geared to the requirements of the customers who rightfully demanded high quality. In some instances, color matches never came up to the standards, so painting the surfaces was the final solution. In other instances color matches were obtained only after many failures.

Another source of trouble was the reduction in thickness of some of the drawn parts. Increasing the starting thickness of the sheet and improved forming techniques helped overcome this trouble.

Some trouble was experienced in cementing vinyl sheeting to partitions. The cements used caused the sheeting to stain badly. The problem was finally solved by backing the vinyl with a cotton jersey fabric and by the development of non-staining adhesives.

Problems of warpage, adhesion, delamination, and appearance were encountered. Some have been solved, others are still prevalent. All concerned are doing their utmost to eliminate the rough spots.

If Convair Liner service reports over the next few years are favorable, it is very likely that new airplane designs will incorporate even greater quantities of plastics.

Plastics Tooling

(*Continued from pp. 74-75*)

mechanically controlled by proper design and fabrication.

There are still several details that must be solved, but these details are not of such proportions that they will prevent even the beginner from making usable tools of the new ethyl cellulose compounds.

Several precautionary notes should be considered at this time. They are few, but important. They are as follows: 1) Avoid sharp corners and radii. 2) Avoid beads close to the edge of the tool, especially when forming heavy material. 3) Avoid using the plastic in tension or shear unless the material is trapped.

If these design "don'ts" are observed, very few difficulties will be found with the new compounds.

Complete information is available to those wishing to produce drop hammer dies by this method.

The government has requested a substitute material for critical lead and zinc for producing various tooling types. We feel that such a substitute has been found.—END

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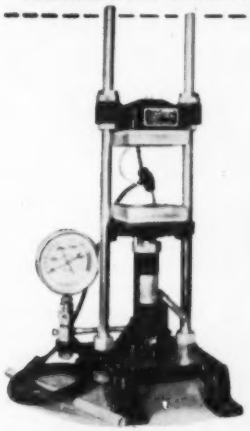

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Plastics Guitar

(*Continued from pp. 76-77*)

way as it was for the working model. Molded inside the neck is a metal shell with 21 horizontal raised frets.

Ethyl Cellulose Parts

The other plastics parts of the guitar which are molded of Ethocel ethyl cellulose include the round top of the six tuning keys; the facepiece which covers the concave head of the neck; decorative symbols, including trade name and trade mark; the bottom half of the faceplate; an extension lug; and various other small tuning controls.

The guitar neck, which incorporates most of these plastics pieces, is actually a piece of precision machinery. In assembling the neck, the tuning keys are inserted through holes molded-into the head of the neck and are provided with a planetary gear system for easy tuning. The bottom half of the headplate and the facepiece—both also with molded-in openings—are then cemented over the head of the neck, sealing the entire tuning mechanism.

The decorative ethyl cellulose pieces are cemented to the facepiece and each of the guitar strings is attached to one of the small ends of the tuning keys which protrude through the holes in the facepiece.

Several disadvantages characterize the wooden guitar. Under the influence of atmospheric conditions—humidity, dryness, heat, or cold—the wooden neck warps, the fretting becomes defective, and the wooden body of the instrument expands or contracts thereby affecting the tonal qualities.

In contrast, the plastics guitar retains the uniform properties inherent in plastics materials and is completely unaffected by atmospheric conditions. Uniformity is of particular value in the neck of the guitar, which needs a permanent, true alignment in relation to the strings for good results. In all of the plastics guitars that have been produced so far, the pitch has continually remained so perfect that the human ear is unable to find a note in the scale that is sharp or flat.

The combination of high impact-high resistant styrene and tough ethyl cellulose has proved much more durable and stable in this application than the conventional wood model. Since plastics do not have the grain of wood, there is no tendency to split or crack.

The complete plastics guitar weighs only 4 lb., as contrasted with many types of wooden guitars which weigh as much as 30 pounds.

Appearance

The shape of the plastics guitar conforms with standard design for stringed instruments—a figure-eight body with a semi-circular cut-away at the top right hand corner for greater ease in reaching the high-pitched notes. The integral color of the plastic body also simulates the accepted style of a spruce soundboard and a rosewood or mahogany body.

The high quality plastics guitar is available at an exceptionally low price. Wooden models sell for anywhere from $60 to $1000. The plastics guitar will sell for only $30 for a flat topped model and $40 for an arched top. Thanks to plastics, the dream of bringing guitar music into every home at a low cost has become a reality.—END

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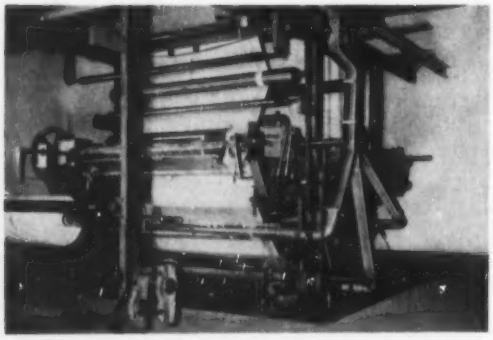

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Breathing Film

(*Continued from p. 90*)

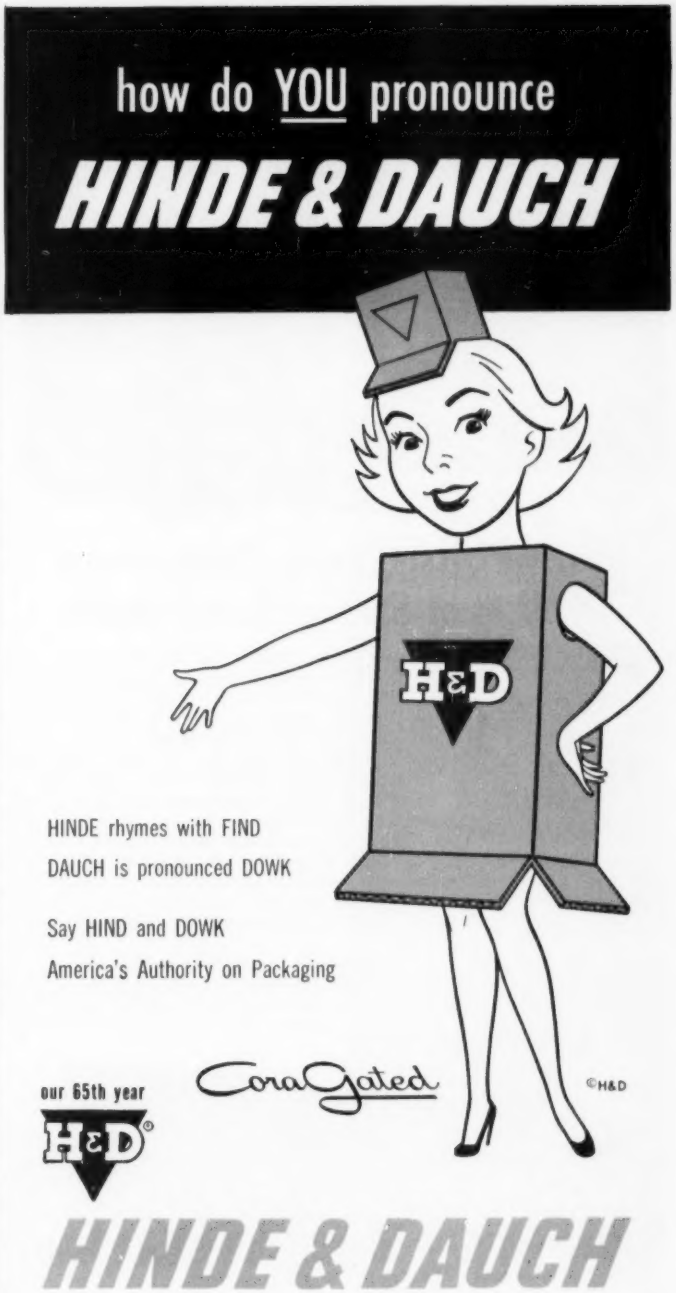
Both tensile and tear strengths are equal to those of the company's non-porous film and are above the levels established under the proposed S.P.I. film standards. A full range of colors will be available in the new material. All types of sealing by sewing, solvent, adhesives, heat, and electronic methods are usable with the new material. All commonly used types of printing may be applied, but the amount and density of the ink used per square foot will vary since too much ink would plug up the pores and render the material less useful.

The cost of the breathing film is from 10 to 15% higher than that of the regular Goodyear film line in each gage. And the company is cooperating with its fabricator customers in the development of suitable descriptive and informative labeling to promote items made from it.

Applications

Concurrently with the introduction of the new film, the following items were presented to the retail trade and to the public: men's raincoats in tan and gunmetal gabardine finish, and women's raincoats in clear and colored taffeta finish by Cable Raincoat Company, Boston, Mass.; mattress and pillow covers by Philmont Mfg. Co., Englewood, N.J.; bibs and aprons for infants by Peerless Specialty Co., New York, N.Y.; Cuff-etts for office workers by Angler's Products Co., Flushing, N.Y.; baby pants and other baby items by H. H. Cutler, Grand Rapids, Mich.; chair pads over foam rubber cushions by Harn Mfg. Co., Cleveland, Ohio; pillow case and mattress covers in clear finish by Plastic Film Products, Akron, Ohio.

No statement is as yet available from Goodyear at policy level concerning the possibility of future licensing of the process to makers of heavier-gage vinyl sheeting for the furniture and footwear trades, to other producers of vinyl films, or to producers of films made from other thermoplastics. It has been established, however, that the process is quite adaptable to the perforation of all types of thermoplastic films as well as thermoplastic sheeting up to 20 gage.—END

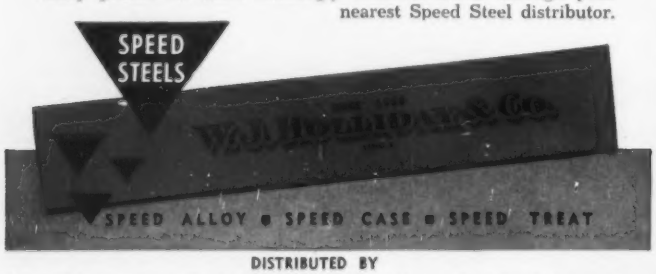


High Polish, Less Distortion Says User of *Speed Treat* Molds

National Motor Bearing Co., makes oil seals by the millions—for washing machines to submarines! Naturally this tremendous volume calls for molds that can take the heavy pressures—and take them longer.

The slightest distortion could mean costly waste. Two of Holliday's Speed Steels, Speed Case (X1515) and Speed Treat (X1545) are whipping this pressure problem on National's synthetic rubber oil seal flanges and other parts, reports George Corsi, Chief Engineer, who further advises . . . "highly satisfactory performance attributable to Speed Steels fine grain structure . . . the high polish they take and their low deformation under pressure. The free machining qualities are also an important advantage."

Speed Steels are finding new ways to save time and money on countless applications—from road ripper teeth to die sets and shoes. Keep posted on these amazingly versatile steels through your nearest Speed Steel distributor.



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Produced by W. J. Holliday & Co., Inc., Speed Steel Plate Division, Hammond, Indiana. Plants: Hammond and Indianapolis, Indiana

Blast Off!

(*Continued from pp. 91-93*)

guns are completed with each cycle, using a 16-cavity mold.

The Ray-O-Matic is an automatic repeating gun which fires six lightweight, hollow styrene balls per loading. It was designed to appeal both to the space-minded youngsters and to adults who might use it for target practice.

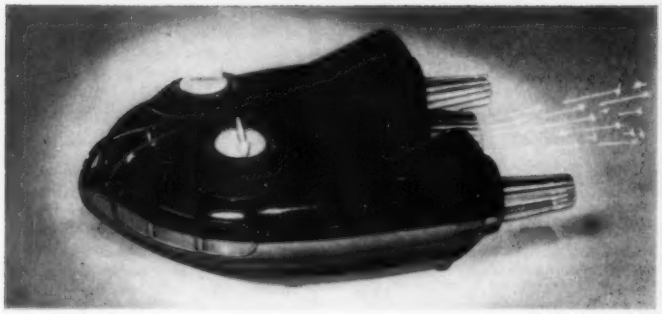
The translucent Cosmic Jet Water Gun is molded by Wes-Ko Products, Los Angeles, Calif.

Brightly colored, streamlined, and mechanically engineered for greater pumping performance, the Cosmic Jet has proved a high-powered attraction for youngsters. By this sales appeal and that of a large number of similar plastic guns that are currently flooding the juvenile market, the water pistol has found a revival as an important staple of the toy field.

Acetate Lenses

In designing the accessories that the well-dressed space traveler will wear, goggles become almost as important as the helmets. Like

Styrene space man, with helmet and rocket guns, is a mechanical wind-up toy



Courtesy Irwin Corp.

Futuristic space car, molded of styrene, has a friction sparking motor, twin jet exhaust pipes projecting from the rear, and two simulated directional control knobs

the helmets, the majority of the goggles are fabricated of acetate and for much the same reasons—optical clarity, non-flammability, light weight, ease of fabrication, and durability.

The acetate lenses may be either transparent, as in the goggles which are part of the space man's uniform made by Caris-Art, Inc., Brooklyn, N.Y., or colored, as in the gun and goggle set made by Plastic Art Toy Corp. of America, East Paterson, N.J.

In addition to the transparent all-acetate goggles, the Caris-Art set includes an adjustable space belt, a flight vest, and cuffs—all fabricated of 20-gage vinyl embossed with a simulated leather effect—and a styrene space gun.

Space Men and Space Cars

In the model toy field, the growth of space consciousness has changed the appearance of the toy counter. Today, plastic rocket jet cars and helmeted space figurines are rated equal space with two of the traditionally biggest sellers in this category—racing cars and model soldiers.

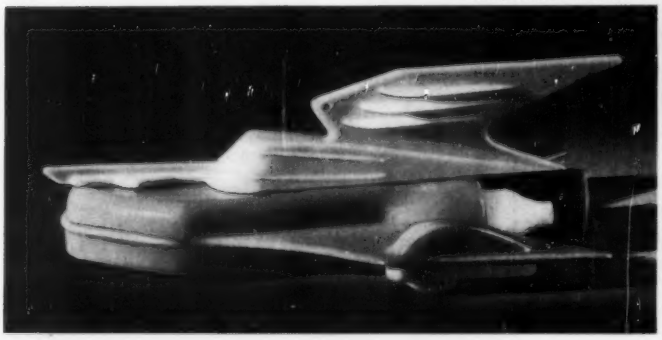
Irwin Corp., Fitchburg, Mass., is marketing both a space car and a mechanical wind-up space man. The car is molded of styrene and has a friction-sparking motor located between twin jet exhaust pipes.

The 12 in. high styrene Man from Mars is dressed in typical space fashion with transparent helmet, stylish uniform, radar antenna, and ray guns. When moved forward by the spring motor, the space man walks along with a slow, weaving gait, his arms and guns swinging up and down.

Plasticraft Mfg. Co., Arlington, N. J., also markets both rocket car and space travelers. The twin-engined rocket car, with two space

Ruggedly-built three-wheel space car, molded of high-impact styrene, utilizes streamlined styling and bright colors in keeping with the interplanetary travel theme

Courtesy California Moulders, Inc.



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pilots, is molded of Dow No. 475 high-impact styrene and is silver sprayed to add more sales appeal. The 2 in. high outer space travelers, available in a variety of different action positions with different atomic weapons, are also molded of brightly colored styrene.

California Moulders, Inc., El Monte, Calif., mold a three-wheel styrene space car with swept-back wings and a sloping central fin rising vertically from its center.

Action Toy

Best Plastics Corp., Brooklyn, N.Y., offers a styrene model of a Rocket Gun Space Ranger which shoots harmless pellets. Cemented into the arms of each of the [illegible] is an imaginative bazooka-shaped weapon. Pellets inserted into the barrel of the gun are propelled by a spring plunger.

The six styrene pellets which are supplied with each rocket gun are molded in one shot and packaged as they come from the mold, still attached by a thin sprue to a 2 in. long bar. The pellets can be easily broken off from the sprues.

The trend toward space travel as an over-all theme has shown its effect on many different phases of the juvenile market. Thus, children's toys, as remote from space travel as pocket knives, pocket flashlights, and bubble pipes, are being dressed up as futuristically streamlined plastics products to appeal to the space-conscious lad.

A bright red and yellow styrene pocket knife is a product of Camillus Cutlery Co., Camillus, N.Y., and is molded with rocket fins, raised port holes, and a hollow rocket head into which a supersonic siren is built. The polyethylene "mooring thong" attached to the knife can be tied to belt or wrist.

Bantam-Lite Sales Corp., New York, N.Y., molds a luminescent pocket flashlight of styrene. Called the Rocket Ray, the unit is colored in sky blue and white and is decorated with stars, planets, and similar symbols of outer-world exploration.

Sales Requirements

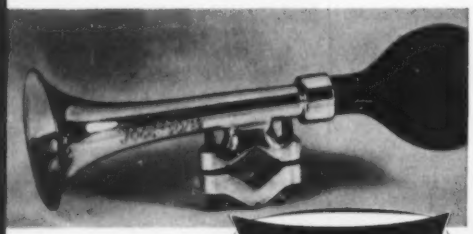
A styrene bubble pipe is molded for Mattel, Inc., Los Angeles, Calif., in the form of a rocket ship. A flexible mouth tube is attached to the turret of the ship. Peerless Plastics, Culver City, Calif., is the molder.

Under the impact of space consciousness, even children's toiletries have been transformed into practical, appealing toys. Vantines, New York, N.Y., accomplishes this by using squeezable polyethylene shampoo bottles, suppled by Elmer E. Mills Corp., Chicago, Ill., and colorfully decorating them with pictures of the cast of a popular TV space show. The soap which is included in this toiletry set is carved in the shape of a space ship.

The sales record of the space theme has taught the toy manufacturer a valuable lesson. He has learned that you can create interest in a toy because of a popular symbol, but you still cannot sell it unless it is an attractive, functional, safe, and durable product.

The use of plastics in the construction of the space toy has provided the perfect solution. The plastic space toy is first a quality plaything—and then a streamlined, outer-world unit that can be vigorously promoted into a volume sales category.—END

This, believe it or not, is a plastic horn!



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Atomic Radiation

(*Continued from pp.* 111-116)

these experiments is that a solvent radical not only abstract hydrogen atoms from the polymer but also transfer enough energy to break the chains.

In Fig. 3 all the curves are for solutions in carbon tetrachloride; the dashed lines indicate periods of non-exposure to the γ-radiation. It can be seen that in the absence of the inhibitor, diphenyl picryl hydrazyl (DPPH), the degradation continues and then levels off. During this aftereffect period, heating to 100° C. for 1 hr. (curves 6 and 7) increases the degradation. The aftereffect is about the same in the three polymers.

At the low intensity (Fig. 2) the presence of about 0.004 g./100 ml. of DPPH inhibited the rate of viscosity decrease considerably. But with the higher intensity (Fig. 3) and greater quantity of inhibitor, 0.015 to 0.06 g./100 ml. there occurred initially with the larger amounts some increase in degradation. There is very likely an optimum concentration and the fact that the higher concentration of DPPH showed initially about the same or more degradation infers that direct action on the inhibitor occurred, producing radicals in relatively large numbers. It is also seen in Fig. 3 that a small amount (1%) of mercaptan greatly retards the degradation. Mercaptan may capture the radicals produced by the radiation more rapidly than the polymer, and mercaptyl radicals may not be as active in attacking the polymer as radicals derived from carbon tetrachloride. Also, mercaptyl radicals may play a role in deactivating the active polymer chains before oxygen atoms can react.

The presence of inhibitor during irradiation largely eliminates the aftereffect, as can be seen in Fig. 3. DPPH was also added to solutions of polymer immediately after irradiation, but a large aftereffect was nevertheless observed. Consequently, the action of the inhibitor on the aftereffect occurs during irradiation.

These results on γ-ray-induced degradation are somewhat similar to those found by Butler and Conway (5, 6) for the degradation of nucleic acid by x-rays in aqueous solutions. Our experiments conducted in non-aqueous systems would indicate that hydrogen peroxide is not necessary for the degradation reaction.

The simplest interpretation of the results so far obtained in the present work is based on the concept that, in the absence of oxygen and inhibitor, chains are broken by the action of radicals derived from the solvent. If these chains recombine, no decrease in flow time will be observed. However, in the presence of oxygen, these chains react with oxygen molecules and subsequent reactions lead to permanent scission of the polymer molecules. The action of high concentration of inhibitor would also lead to permanent scission by tying up the polymer radicals before recombination of such radicals could occur, as well as by contributing to the production of radicals by the direct action of γ-rays. The inhibitor apparently produces free radicals at a higher rate than the solvent by the direct action of γ-rays. In low concentrations the inhibitor apparently retards the degradation by removing solvent radicals as fast as they are formed. If during the decomposition in the absence of inhibitor a considerable

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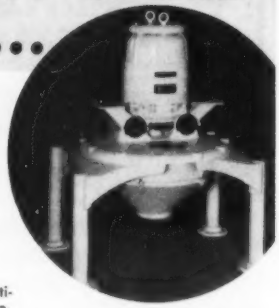

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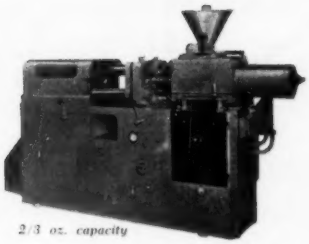

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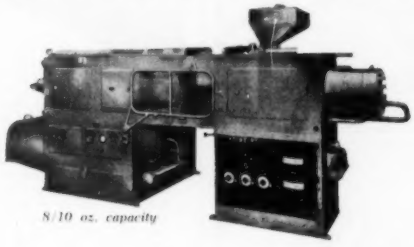

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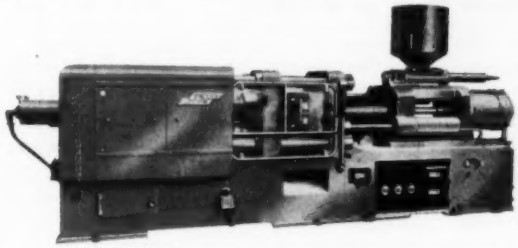

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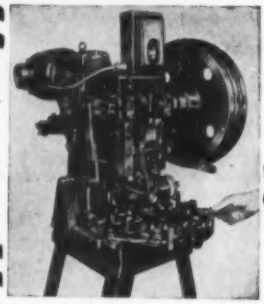

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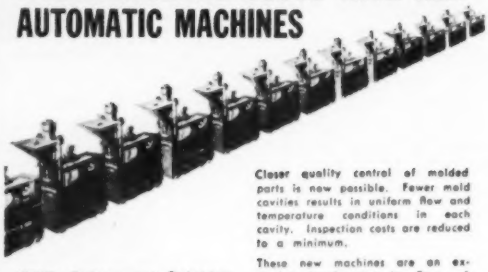

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number of polymer radicals, after adding a molecule of oxygen, combine with another polymer radical to give peroxide structures, P—O—O—P, then we have a basis for the explanation of the after-effect, assuming these peroxide links undergo decomposition at room temperature. The mechanism postulated above then appears adequate if, in the absence of oxygen and inhibitor, all the large radicals recombine. The action of the oxygen and inhibitor can then be to alter the effective ratio of combination to disproportionation and hence produce the observed decreases in viscosity. The formation of the peroxide intermediate would essentially produce a delayed disproportionation. Higher temperatures, but below the pyrolysis point, should eliminate the after-effect and produce degradation in the absence of oxygen or inhibitors by increasing the degree of normal disproportionation. Also at higher temperatures the depolymerization of polymer radicals into monomer should become important.

The above interpretation encounters certain discrepancies. It is based on an assumption that in the absence of oxygen and at ambient temperature the recombination of polymer radicals exactly compensates dissociation. It also implies that at the higher concentrations, DDPH either is less capable of capturing the radicals formed in the solvent by the radiation of a large number of radicals. This last hypothesis is in contradiction with the results of a recent detailed study by Boas, Chapiro, Ebert, and Gray (7).

A possible alternate mechanism is that the radicals formed due to the effects of the radiation induce a slow oxidation of the polymer, followed by degradation (oxydative). This type of mechanism assumes the formation of hydroperoxide groups along the polymer chain, and their subsequent decomposition might provide a basis for the aftereffects observed. The degree of stability of such known compounds as cuemene, hydroperoxide is not favorable, however, to this premise, which also fails to explain the degradation observed in the presence of DDHP.

The senior author wishes to thank Drs. I. Landler and A. Chapiro for their interest and helpful suggestions in this study and to thank Prof. Bauer of the Laboratoire de Chimie Physique for the opportunity to conduct this work during a Fulbright Grant tenure.

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Degradation

(*Continued from pp. 118-124*)

two intrinsic viscosities. The notation $D(\frac{B}{W})$ indicates that D is a function of the moles of base added per gram of polymer; therefore, to compare distribution in a set of polymers, B/W must be kept constant. While this method necessarily assigns distribution to a more arbitrary scale than a comparison of two absolute measurements, it has the decided advantage of employing only the most convenient index of molecular weight, intrinsic viscosity.

Results on a series of partial conversion acrylonitrile polymers are given in Table VI to illustrate the method. Solutions of the polymers

Table VI—Conversion and Molecular Weight Distribution in Polyacrylonitrile

Conversion	$D \times 10^3$
%	
6.5	2.4
12.1	1.7
32.5	2.5
46.7	1.1
76.0	5.0

were reacted with sodium hydroxide (B/W = 10^{-4} moles base/gram polymer), allowed to stand 1 hr., neutralized with hydrochloric acid, and intrinsic viscosities determined by relative flow time measurement. The difference between the first three samples is not significant. The distribution at intermediate conversion (46.7%) is sharper than in the lower conversion samples, and there is a significant broadening of distribution at the highest conversion. This technique is expected to be useful where a rapid indication of the effect of process variables on molecular weight distribution is desired.

Appendix

Montroll and Simha[5] have derived an expression for the weight average molecular weight, M_w, of the distribution of molecules resulting from the random scission of a sharp fraction of initial molecular weight M_0:

$$M_w = M_0 \frac{a^2(1+C)+2(1-a)/(1-a^{C+1})+a(1+C)-1}{a^2(1+C)^2} \quad (1)$$

where C = initial number of bonds per molecule, 1 + C = initial num-

[5] Montroll, E. W. and Simha, R., J. Chem. Phys. 6, 721-727 (1940).

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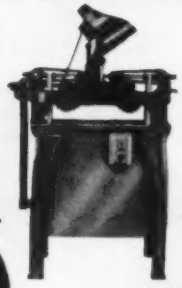

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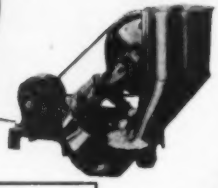

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ber of monomer units per molecule, and a = degree of degradation = r_o/C, where r_o = average number of cuts (i.e., bonds broken) per molecule. This equation will serve as the basis of discussion of two subjects referred to above.

M_w when a and C are large—When a and C are so large that $(1 - a)^{C+1}$ is very small, equation (1) becomes

$$M_w = \frac{2\,M_o}{r_o} \qquad (2)$$

If there are n molecules of polymer originally present,

$$r_o = R_o/n \qquad (3)$$

where R_o = number of cuts. But

$$n = \frac{NW}{M_o} \qquad (4)$$

where W is the total weight of polymer and N is Avogadro's number. Combining (2), (3), and (4)

$$M_w = 2\,\frac{W}{R} \qquad (5)$$

where R is the total number of cuts expressed on a molar basis, i.e.,

$$R = R_o/N \qquad (6)$$

Thus, M_w does not depend upon the original molecular weight, but on total number of cuts per g. of polymer.

Consider now the degradation of a distribution of molecules of different weights $(M_o)_i$, where the index i = 1,2,3, etc., is used to distinguish between the different molecular weights present in the mixture. The weight average molecular weight $(M_w)_i$ of the distribution resulting from making r_i cuts per molecule in the n_i molecules of molecular weight $(M_o)_i$ is, from equation (2),

$$(M_w)_i = \frac{2\,(M_o)_i}{r_i} \qquad (7)$$

M_w of the mixture obtained from degrading all the molecules of species i in the original distribution is

$$M_w = f_i\,(M_w)_i = 2\,\Sigma\,\frac{(f_i\,M_o)_i}{r_i} \qquad (8)$$

But, from equations (3) and (4) (since total number of cuts in molecules of species i is proportional to weight fraction of that species)

$$r_i = \frac{f_i\,R_o}{n} = \frac{f_i\,R_o\,(M_o)_i}{N\,W_i} = \frac{R_o\,(M_o)_i}{NW} \qquad (9)$$

where f_i is the weight fraction of species i. Therefore, combining equations (6), (8), and (9)

$$M_w = 2\,\frac{W}{R}$$

which is identical with equation (5),

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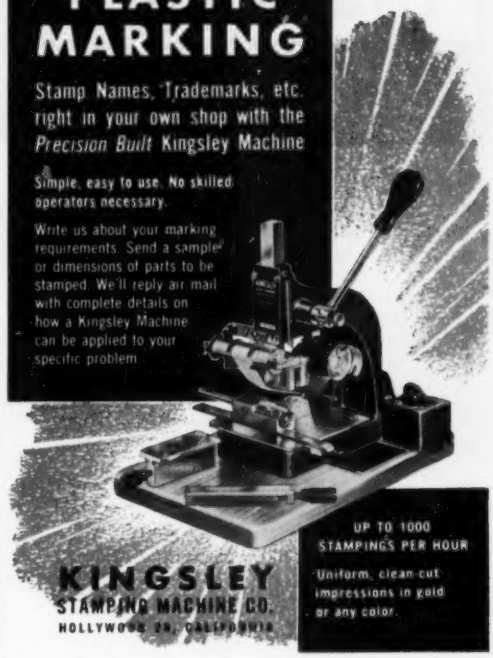

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derived with the assumption that all the initial molecular weights were equal. Thus, distribution does not affect final average molecular weight.

The stoichiometric relation between moles of base added, B, and the degradation produced in the reaction of base with polyacrylonitrile can be obtained from the above relations. Denoting by k the efficiency of the base in producing scission:

$$R = kB \qquad (10)$$

equation (5) becomes (dividing both sides of the equation by $(M_w)_o$, the original weight average molecular weight)

$$\frac{M_w}{(M_w)_o} = \frac{2}{(M_w)_o}\frac{W}{kB} \qquad (11)$$

It follows from the intrinsic viscosity-molecular weight relation

$$[\eta] = KM^a \qquad (12)$$

that for broad distributions of polymers such as polyacrylonitrile which have $s = \frac{2}{3}$ that

$$\frac{M_w}{(M_w)_o} = \left[\frac{[\eta]}{[\eta]_o}\right]^{3/2} \qquad (13)$$

Combining equations (11) and (13) and rearranging, proportionality between $[\eta]^{3/2}$ and B/W is obtained:

$$[\eta]^{-3/2} = \frac{k(M_w)_o}{2[\eta]_o^{3/2}}\frac{B}{W} \qquad (14)$$

This is the theoretical basis of Fig. 3 from which k was evaluated.

M_w when r_o is small—For the early stages of the degradation, i.e., when r_o is small, $(1 - a)^{C+1}$ may be represented by the first few terms of a power series, and equation (1) becomes [using equations (3) and (4)]

$$M_w = M_o - \frac{r_o}{3}M_o = M_o - \frac{R}{3W}M_o^2 \qquad (15)$$

Thus, the initial molecular weight change in a degradation reaction depends upon the square of the initial molecular weight.

Considering again the degradation of a distribution of different molecular weights, from equation (15)

$$M_w = \Sigma f_i (M_w)_i = \Sigma f_i (M_o)_i - \frac{R}{3W}\Sigma f_i (M_o)_i^2 \qquad (16)$$

Since

$$\Sigma f_i (M_o)_i = (M_w)_o \qquad (17)$$

$$\frac{M_w}{(M_w)_o} = 1 - \frac{R}{3W}\frac{\Sigma f_i (M_o)_i^2}{(M_w)_o} \qquad (18)$$

The quantity $f_i(M_o)_i^2/(M_w)_o$, which has the dimensions of a molecular weight, occurs in ultracentrifuge theory and has been defined as the Z average molecular weight, M_z (see footnote 4, p. 124):

$$M_z = \frac{\Sigma f_i M_i^2}{\Sigma f_i M_i}$$

Since M_z depends upon distribution, the early stages of the degradation must depend upon distribution. Conversely, a study of the initial degradation furnishes an insight into the original distribution.

The degradation data may be analyzed in terms of a distribution characterizing parameter D, defined by

$$D = \frac{R}{3W}\frac{M_Z}{[\eta]^{3/2}} \qquad (19)$$

which is proportional to M_z/M_w. M_z/M_w is unity for a sharp fraction and increases with the broadness of the distribution; e.g., for high conversion condensation polymerization it is 1.5. Thus the parameter D increases with the broadness of the distribution. Combining equations (13), (18), and (19), an expression for D involving only the initial and final intrinsic viscosities is obtained:

$$D = [\eta]^{-3/2}[1 - ([\eta]/[\eta]_o)^{3/2}] \qquad (20)$$

END

THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Low-Cost Plasticizers for Vinyl Attract Attention

VINYL processors have their eyes on the hydroxylation of fats as the source for another line of plasticizers that will probably be low in cost, will have about the same volatility as DOP, and will have relatively good low-temperature brittleness properties.

Roughly speaking, hydroxylation is a process for treating inexpensive vegetable oils or other fats to improve their compatibility with vinyl chloride resins and improve the plasticizer stability against oxidation. There have been various types of oil-derived plasticizers on the market for a long time, but the new hydroxylated type offers a broadening of the field. Oil-derived plasticizers are generally used as secondary plasticizers to improve handle and frequently for better flexibility at low temperature.

The Baker Castor Oil Co., 120 Broadway, New York 5, N. Y., with 93 years of production experience on hydroxylated fats, has announced two new plasticizers produced by a modification of the peracetic acid process for hydroxylation which was developed by the Eastern Regional Laboratory of the U. S. Dept. of Agriculture. The plasticizers are named Estanox 203 (butyl hydroxyacetoxy ester) and Estanox 206 (butyl poly-acetoxy ester).

Both are stated to be efficient secondary plasticizers for vinyl. Estanox 203 is also considered a stabilizing plasticizer because of its epoxy content. Both esters are also primary plasticizers for cellulosic resins and synthetic rubber. They are reported to have more compatibility with vinyl than other oil-type plasticizers, lower volatility, greater resistance to u-v exposure, stability to oxidation, and freedom from rancidity.

In pilot plant production, they are marketed at less than 40¢ a lb.; when in commercial scale production, they will probably sell in the low thirties.

Baker officials, however, point out that although the new Estanox plasticizers have relatively good low-temperature properties, they are not recommended for the more extreme low temperatures where the ricinoleate plasticizers fit in at a low price of 33¼¢ a pound.

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LOW in cost, an aromatic hydrocarbon resin plasticizer that is compatible with practically all plastics materials is now making considerable impact on the industry after several years of trial and experimentation by processors. Called Kenflex, it is produced by Kenrich Corp., 57-02 48th St., Maspeth 78, N. Y., and sells for 27¢ a pound.

A little more costly than most other petroleum-type plasticizers, Kenflex is a polymeric plasticizer and non-volatile. In addition, it has greater solvent power than other petroleum types and is an exceptionally good wetting agent.

When used in a vinyl chloride compound, Kenflex increases fluidity at the processing temperature and helps increase speed of extrusion flow in the mold. When used as a plasticizer for wire coating, other lubricants can be omitted. As little as 2 or 3% in the compound also improves electrical resistance—in larger quantities it has been known to increase d-c resistance from 10 to 50 times.

It is used in vinyl phonograph records because it is reported to improve the surface, help to eliminate surface noise, and speed up the molding process. This same fine surface quality is also advantageous in vinyl extrusions.

Another application is in floor tile, where it is claimed to permit higher loading with filler materials and thus reduce cost of the compound. It also enables the manufacturer to process at lower temperatures so that he can make vinyl tile on equipment formerly used for rubber. Since the product's water absorption is practically nil, its use is stated to improve moisture resistance of floor tile.

Plastisol compounds used in caulking auto bodies can also be improved by using Kenflex because it won't exude and spoil the paint with which the caulking must be covered. It is also used in plastisol inks of the type used for printing magazine covers because of its quick fluxing and glossy surface characteristics.

A recent job was its use as a processing aid with butyl rubber which was jacketed over polyethylene insulated wire—the Kenflex helped eliminate contamination of the polyethylene by migration from the butyl.

There are limitations for the use of Kenflex just as there are with other plasticizers. Its light stability is not good and it contributes nothing to low temperature flexibility. The colors with which it is used are generally black or brown; consequently, it is seldom used in vinyl film or sheeting. Of course, these are serious limitations, but there still remain scores of applications where Kenflex can be an economical, efficient plasticizer.

• • •

COMPREHENSIVE research for a group of manufacturers of vitrified clay sewer pipe has now been going on for several years at the Engineering Experiment Station of The Ohio State University, Columbus 10, Ohio. The major phase of this program has been the development of better joints for sewer pipe. Early in the investigation it became evident that plastisols were the most promising plastics for giving desired properties at reasonable cost, although the researchers are still interested in any other types that show promise. Patents covering design and methods of joining have been applied for.

J. O. Everhart, research professor

* Reg. U. S. Pat. Off.

VISIBILITY

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in the F 3H "Demon"

This McDonnell designed carrier-based jet fighter, being produced by the McDonnell Aircraft Corporation, St. Louis, Mo. and Temco Aircraft Corp., Dallas, Texas, depends on its SWEDLOW manufactured canopies and windshields.

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in charge of this study, says that at present no one is commercially producing clay pipe with plastisol joints, although Robinson Clay Product Co. has a number of test lines running.

The research group has also placed a number under test. Several concerns are about ready to install equipment and start commercial production, it is reported.

If bituminous materials now used to make prefabricated pipe joints can be replaced, the quantity required could reach 20,000 tons per year, but it is expected that the consumption will be a gradual rather than a rapid development.

It is generally believed that users of plastisol for producing these prefabricated joints will purchase the compounded material and do the fusion on the pipe in their own plants. Initial requirements per plant should be in the vicinity of one half to one ton per day. If consumption becomes sufficiently large, some of the larger users will probably undertake the compounding themselves.

An interesting angle about this particular plastisol development is that Sovaloid C, a 13¢ petroleum derived plasticizer seems to be an important factor in the development. It appears that a 50-50 mix of DOP and Sovaloid C may give satisfaction.

• • •

INTRODUCTION of a new polymeric plasticizer for vinyls has been announced by Archer-Daniels-Midland Co., 600 Roanoke Bldg., Minneapolis 2, Minn. The product is an epoxy triglyceride with good low-temperature flexibility and resistance to ultra-violet light and heat.

Company spokesmen assert that this new plasticizer for vinyl chloride broadens the market for agricultural products because it is processed from soybean oil.

Laked Pigments

ANNOUNCEMENT of a newly developed series of laked colors has been made by Claremont Pigment Dispersion Corp., 110 Wallabout St., Brooklyn 11, N. Y. In contrast with conventionally laked pigments, the materials are in completely dispersed form and ready for use, having been laked on a resin base. The physical appearance of the product is that of a finely divided, free-flowing powder.

Current applications for the laked pigments are seen in vinyl extrusions and inks. It is also possible that they may be used in styrene, cellulose acetate, and synthetic fibers.

Polyester Producer

ANOTHER step in the proposed long-range diversification plan of Celanese Corp. of America is the purchase of Marco Chemicals, Inc., Linden, N. J. Marco Chemicals is one of the original producers of polyester resin.

Celanese officials predict that the demand for polyester will more than triple in the next five years. Production in 1952 was around 20 million pounds.

Dr. Irving E. Muskat, founder and former president of Marco will join Celanese and assist in the operation of the polyester business.

Standards for Vinyl Film

COMMERCIAL standards for vinyl film became effective May 22, 1953, after the National Bureau of Standards had received acceptance of circulated copies by a majority of the film producers. They will be known as General Purpose Vinyl Plastic Film Commercial Standard CS192-53. Copies may be purchased from the Supt. of Documents, Government Printing Office, Washington 25, D. C.

These Standards, drawn up for the mutual protection of manufacturers and customers, specify minimum performance and methods of testing for 10-mil film or less, including transparent, translucent, and opaque material—whether plain, embossed, molded, or otherwise surface treated. They deal with such things as dimensional tolerance, tear resistance, shrinkage, contamination, appearance, crocking and other properties.

The new Standards are not considered a panacea that will settle the problems of the vinyl film industry, but they at least provide a base from which to start improvement and offer a means by which buyer and supplier can agree on test methods and quality. Unquestionably, film that does not meet the promulgated Commercial Standards' test requirements will be sold by some producers, but such producers will have their own particular problems to solve in explaining their position in relation to industry practice.

It is hoped that the next industry-wide step in improving the film situation will be adoption of a code similar to the Worth St. Rules in the textile industry, whereby customers and producers establish a standard of business ethics concerning such things as returned goods; liabilities; guarantees; and financial practices. If such a set of ethics could be tied in with the newly approved Commercial Standards, the industry could probably get out of its present unpleasant situation of big production but tiny profit.

Polyethylene Price Trends

POLYETHYLENE prices have dropped 56% in one decade despite rising labor and material costs in all industry, declared H. S. Bunn, president of Bakelite Co., at that company's recent demonstration of polyethylene progress.

Further significant statements by Mr. Bunn made on the same occasion include the following: "In producing polyethylene, the same pressure is developed as at the moment of firing a Navy anti-aircraft gun with a 5-in. bore. The gun sustains this pressure for only a fraction of a second, but equipment for producing polyethylene must stand it continuously around the clock. It is, as far as we know, the highest pressure (35,000 p.s.i.) at which any commercial process operates continuously today . . .

"Today, one of our operating units at S. Charleston produces the same amount of polyethylene it took six units to produce in 1943. In other words, due to radically new engineering and production techniques, Carbide and Carbon Chemicals Co. increased the production rate per unit of investment in equipment by about 600% in 10 years . . .

"Price trends for the major plastics marketed by Bakelite Co. go down as volume and operating effi-

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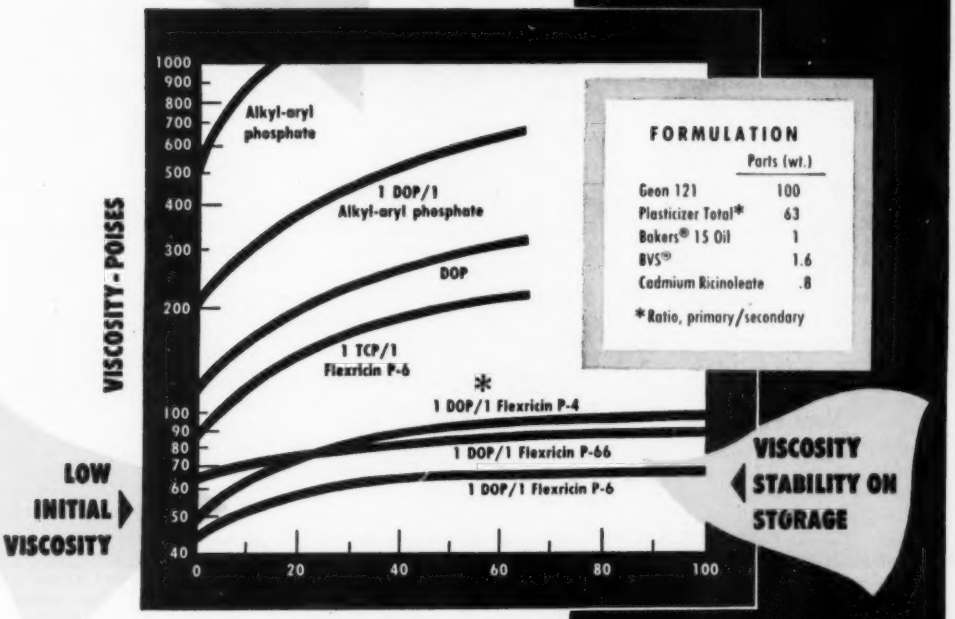

FORMULATION

	Parts (wt.)
Geon 121	100
Plasticizer Total*	63
Bakers® 15 Oil	1
BVS®	1.6
Cadmium Ricinoleate	.8

*Ratio, primary/secondary

YOUR CHOICE:

Flexricin P-4 Methyl Acetyl Ricinoleate
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ciency increase. At least three of these plastics within the past 20 years have more than halved their initial price per pound. Vinylite vinyl chloride-acetate resin appeared on the market in 1934 at an average price per pound of 80¢, and it steadily descended the price ladder until today it is 38¢ per lb., a reduction in price of 53 percent. Bakelite styrene plastic started at 72¢ in 1937 and followed Vinylite down to a 1952 price of 32.5¢, a reduction of 55 percent. The original Bakelite plastic, Bakelite phenolic is today just one-third of the 1924 price of 60¢ per pound . . .

"But Bakelite polyethylene has outpaced them all. Polyethylene's initial price was $1 per lb. ten years ago. Today, base resins of the type sold in largest volume are 44¢ per pound. Bakelite polyethylene has had the greatest percent price reduction of any major plastic within the past 10 years . . .

"I cannot predict exactly what the price will be in 1955 or 1960, but it will certainly be in the thirty cents per lb. range and maybe in the twenties."

More Pipe

CONTINUOUS expansion of the cellulose acetate butyrate pipe industry was indicated recently by the announcement by the Industrial Div., Waljohn Plastics, Inc., 435 88th St., Brooklyn 9, N. Y., that they are now making butyrate pipe with molded fittings to match.

The company has prepared a booklet to assist processors in the selection and installation of plastics pipe, and has opened territories for distributors and dealers in the United States, Canada, and South America.

Plant Replacement

RECONSTRUCTION of American Polymer Corp.'s plant at Peabody, Mass., which was recently destroyed by an explosion, is progressing rapidly at a new location in the same general area. Production will be resumed within a short time, but in the meantime, all customers are being served without delay by the company's plants in Leominster, Mass.; Illiopolis, Ill.; and Toronto, Canada.

American Polymer produces polyvinyl acetate emulsions and solutions, acrylic emulsions and solutions, and other products used by the textile, paper, rubber, chemical, and adhesive industries.

The American Resinous Chemicals Corp.'s plant, which is in a building neighboring the destroyed Polymer plant, is intact and shipments to all customers were resumed three days after the accident.

Adhesive for Polyethylene

PAPER, aluminum foil, and other non-porous surfaces can be bonded to polyethylene with a new emulsion adhesive called ARCCO 980-21D, produced by American Resinous Chemicals Corp., Peabody, Mass. It is recommended for such uses as attaching labels on polyethylene bottles, production of barrier wrap materials, and other applications where non-porous materials are involved.

Decentralized Production

A NEW type of expansion in the plastics industry may be on the way if other processors follow the lead of Tri-State Plastic Molding Co., Inc. Robert K. Gibbs, president, said that his plastics packaging manufacturing company is now prepared to set up branch molding plants almost at the very doorstep of customers whose demand warrants such a move, thus reducing shipping and warehousing costs.

The branch molding facilities will be established at the request of customers whose annual packaging orders are $250,000 or more. The installation may be for as long a period as the customer requires, but not less than one year, and will be operated in rented facilities as close to the plant as possible. A minimum of 3000 to 5000 sq. ft. will be used for molding operations when the customer provides his own warehousing facilities.

These branches will be concerned with producing packaging products only. All other customer dealings with Tri-State will continue to be with the main plant at Henderson, Ky.

Annealed Thermoplastics

AVAILABILITY of annealed styrene and acrylic products through a nation-wide distributor organization has been announced by Plax Corp., West Hartford, Conn.

The distributors will carry complete stocks of Plax polyethylene and styrene sheet, rod, and tubing, and methacrylate rod and tubing.

High-Impact Film

AVAILABILITY of high-impact film, produced from Dow 475 resin, is announced by Extruded Products Div., Gering Products, Inc., Kenilworth, N. J. The material is offered in thicknesses from 0.005 to 0.040 in. in a width of 24 inches. Heavier sheet stock from 0.040 to 0.100 in., or thicker, and rigid tubing in a variety of small diameters are also available.

The company claims the outstanding properties of the film are very attractive for packaging applications, vacuum-forming, and printing. Prices and samples may be obtained upon request.

Silicone Glass Cloth

INTRODUCTION of a new silicone-rubber coated glass cloth Class H insulation with unusual high dielectric strength and increased tensile strength has been announced by Mica Insulator Co., Schenectady 1, N. Y. Both the electrical grade, E-944, and the mechanical grade, E-959, have a dielectric strength approximately twice that required by military specifications and also possess good bending qualities.

The mechanical grade has a surface toughness which is claimed to be greater than previously developed silicone rubber coatings, thus making it ideal for gaskets.

Solid Formaldehyde

DEVELOPMENT of a new solid form of formaldehyde with less than 0.1% water content has been announced by Heyden Chemical Corp., 342 Madison Ave., New York 17, N. Y. The product, called Superfyde, is reported to have special advantages for processing plastics that require formaldehyde but where the presence of water inhib-

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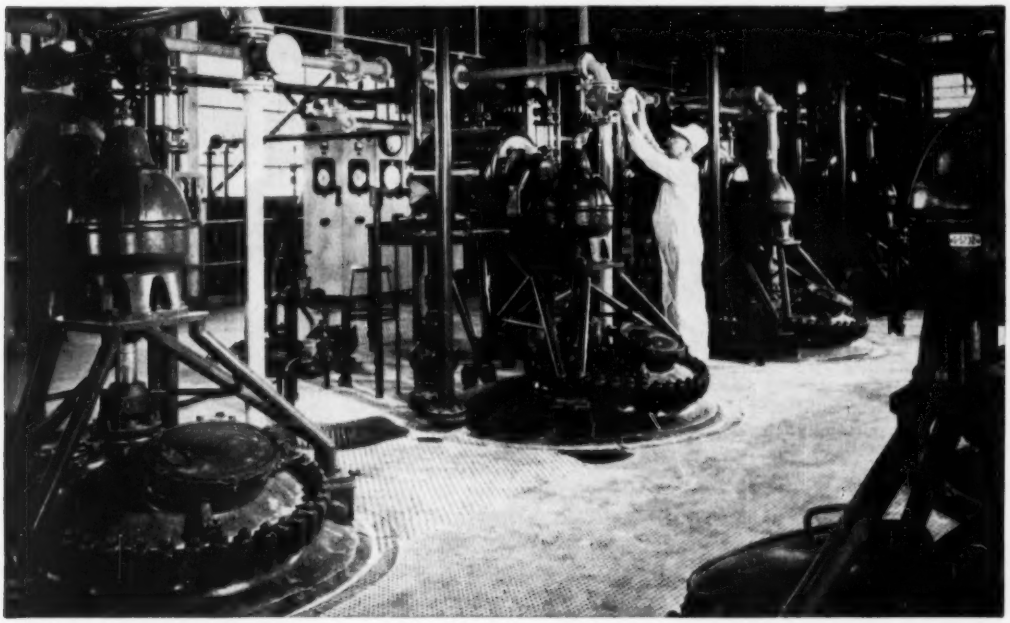

In an extensive polymer plant at Midland, Michigan, Dow is now producing commercial quantities of the highest quality polyvinyl chloride material available to users of plastic resins. The new plant is well engineered for maximum efficiency, with modern equipment and quality control instrumentation.

Dow's experience as a major producer of vinylchloride over a number of years, plus the new PVC facilities devoted exclusively to the production of resin, puts the company in an exceptional position to provide the vinyl industry with a reliable source of quality resin.

At present Dow is supplying production quantities of PVC 100, a Dow polyvinyl resin of particular interest to vinyl film producers and manufacturers in the field of wire extrusion and other elastomeric extrusion products. Dow PVC 100-4, also available, is an extrusion grade resin designed for dry blending. In addition, other experimental resins for calendering are being developed. For details write THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Department PL 1480.

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its or prevents reaction. It is most useful when very slow resinification is desired or when final hardening of the resin is accomplished by heating.

Color Purity

BRIGHT, permanent color has always been a principal selling factor in merchandising plastics. All plastics producers spend thousands of dollars in research and development in order to give their customers a wide range of colors that will not fade and have good eye appeal.

One of the greatest problems has been matching samples—especially since molders are likely to use molding material from all producers and it is frequently difficult for one producer to exactly match some particular shade or color of another producer's material.

It is, therefore, encouraging to note that the tendency to keep on improving this vital part of plastics merchandising goes on continuously so customers may be assured that their suppliers are showing no tendency to sit tight or be complacent over what is already an inventory of "color knowledge" that is perhaps without a match in any other industry on earth.

In line with the policy of keeping "color foremost," Koppers Co., Inc., Pittsburgh 19, Pa., has recently announced that it has now built up its color matching laboratories to ensure just about as complete satisfaction as it is possible for a customer to expect. Technicians there have matched colors of an unbelievable variety of products from knife handles to a bottle of soda pop.

The basic instrument of course is the spectrophotometer which identifies every hue of color by wave length. But since polystyrene uses are so widespread that it might have to endure exposure to various degrees of heat, humidity, light, or fumes, the laboratory workers make a careful study of each item's intended use. Armed with this information, the color specialist selects dyes and pigments necessary to duplicate the sample. These colorants must meet rigid heat and light stability standards and light conditions that vary from light to overcast at various latitudes and various hours of the day. More than 1000 dyes and pigments have been put through rigid tests to arrive at the 30 best upon which Koppers color laboratories base their color formula. A Fade-Ometer and a Weather-Ometer help during these tests.

Colorants chosen by the laboratory specialists are dispersed through crystal-clear polystyrene beads; the mixture is then extruded into filaments, pelletized, and then molded. A color specialist compares the molded disks with the original sample. The specialist has previously verified his perfect color vision in internationally recognized tests. If the color is not right, he makes an adjustment in the formula and the entire process is repeated until the desired shade is obtained and verified by the spectrophotometer.

A larger quantity of material is then molded under typical commercial molding conditions before the matched color is submitted to the customer for his approval.

Color control in plastics has become a combination of science and art. There will probably always be some complaints, but the producers are intent on making them as few and far between as possible.

Corrosion Testing

ESTABLISHMENT of a custom corrosion testing service for industrial environments has been announced by Kenneth Tator Associates, Coraopolis, Pa. Here, for the first time, selected industrial exposures, under rigorous control, are made available to manufacturers of industrial coatings for objective testing of their products.

Heretofore, exposures to atmospheric and marine environments have long been available and proven invaluable to industry. However, the complexity and variety of industrial exposures have discouraged efforts for product testing in these atmospheres.

All the new custom test stations are located in the plants of large industrial companies. Exposures are made directly to plant fume environments such as organic and mineral acids, ammonia, organic solvents, entrainment of corrosive chemicals, high humidity conditions, radiant heat, salt, mildew, and heavy industrial. Other stations will be added as demand develops.

Non-Combustible Solvents

THREE new solvents, Cineclene M-5, Oxylene M-6, and Furfasol M-17 are now being offered by John B. Moore Corp., P. O. Box 3, Nutley 10, N.J. The solvents can be used to replace carbon tetrachloride in specialized fields of cleaning because of comparatively low toxicity and high product efficiency. None of them contain petroleum hydrocarbons.

Furfasol M-17 was formulated to replace acetone and MEK in cleaning latex and resin adhesive products from process equipment. It has solvent properties akin both to halogens and some esters, but its range of usefulness has not been fully explored.

Cockpit Covering

AVAILABILITY of a paulin material for the protection of plastic sections of planes is announced by Du Pont's Fabrics Div., 350 Fifth Ave., New York 1, N.Y. Known as V-Cockpit Cover #3, it is designed to protect planes from hot sun and scratching damage.

The material, which is part of the company's well-known Fabrilite line, is constructed of a soft, nappy fabric base with a high-luster aluminum top coating. Until recently, it has been impossible to produce an aluminum surface for such paulin material with a sufficient degree of reflectivity to meet Air Force specifications.

Conidendrin Stabilizers

A NEW kind of stabilizer for vinyls may become available in the not too distant future, according to chemists in the Bureau of Agricultural and Industrial Chemistry, U. S. Dept. of Agriculture, who have been working with waste products from hemlock in the Southern Regional Research Laboratory, New Orleans, La.

The two new antioxidants, alpha- and beta-conidendrol have been compared with accepted stabilizers in a variety of products and have definite possibilities, according to

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the research technicians. They were developed as inhibitors to prevent rancidity in vegetable and animal oils but have been found useful as stabilizers of synthetic rubber against aging and hardening, and as inhibitors of polymerization of certain vinyl-type monomers.

Reprints of articles containing information on this subject may be obtained from the Southern Regional Laboratory, 2100 Robert E. Lee Blvd., New Orleans, La.

Acrylic Sheet Discontinued

DISCONTINUANCE of the manufacture of cast acrylic resin has been announced by Du Pont. The company reports that the move will not affect its business in Lucite acrylic molding powders or methacrylate polymers.

The decision to cease the manufacture of cast acrylic was reached reluctantly after long and careful study of changes in the cast acrylic business, occurring largely as a result of increasing industry preference for other forms of plastics, the company reported.

Translucent Panel

FULL production of a new and improved type of fibrous glass translucent building panel in plants at Puente, Calif., and Newport, Ark., has been announced by International Glass Corp., Los Angeles, Calif.

The new building sheet is declared to contain over 50% fibrous glass, which gives it extra strength, and is made by cross-laminating long parellel fibers to produce a cloth-like texture.

Three-Dimensional Upholstery

ANNOUNCEMENT of a three-dimensional color depth vinyl upholstery specifically fabricated for dinette manufacturers has been made by Velveray Corp., 15 W. 34th St., New York 1, N. Y. The material, called Fusefilm, is made from The General Tire & Rubber Co.'s Fashon vinyl film.

Fusefilm is fabricated of two layers of vinyl film fused together to make one sheet. The bottom layer carries the design; the top layer is a transparent heavy gage protective film.

Extruder Broadens Base

ACQUISITION of Extruded Plastics, Inc., Norwalk, Conn., has been announced by Vick Chemical Co., 122 E. 42nd St., New York 17, N. Y. The move is another step in Vick's diversification program of acquiring manufacturers of specialty products, according to E. L. Mabry, president. He pointed out that the growth of self-service merchandising, where there is a rapid trend toward transparent packaging, indicated a continuously growing market for this product which has long been a staple item for extruded plastics.

Charles E. Slaughter, founder of Extruded Plastics and a pioneer in the plastics industry, will continue to head the company as president and general manager. He stated that there will be no change in corporate name, company policies, operating methods, or personnel. He also said that a new branch factory, to be established in the Midwest, should be in production on a limited scale before the end of the year.

Vinyl Nameplates

RECOMMENDATION of hard vinyl nameplates for various types of equipment is being made by American Lucoflex, Inc., 500 Fifth Ave., New York 17, N. Y. Because of the resistance of the material to solvents, brine, and other corrosives, the nameplates are suggested as a replacement for metals which usually require anodizing, dichromating, or enameling.

High Gloss Finish

CURRENTLY in use by John W. Crawford Co., 160 Varick St., New York 13, N. Y., is a high gloss liquid plastic finish, called Lustralite, as a finish or laminate on printed stock.

The material furnished to Crawford for this treatment must be coated, preferably of a varnishing grade, and the inks should be resistant to bleed in toluol. A maximum sheet size of 72 by 68 in., gripping the 72-in. edge, can be handled.

The cost depends on the size of the sheet, but it is generally about ¼ to ⅓ the cost of acetate lamination.

EXPANSION

The Goodyear Tire & Rubber Co., Akron, Ohio, will invest approximately $5,500,000 in plant expansions this year. Among the new plants will be a $4 million structure at Niagara Falls which will produce rubber accelerators, antioxidants, and viny chloride resins. The Niagara Falls addition will get under way early this summer.

General Chemical Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y., has announced plans for two more additions to its **Baton Rouge, La., Works** —one for sulfuric acid and the other for trifluorochloroethylene. The latter plant will utilize a new process developed by General Chemical's research and engineering departments for production of organic fluorine compounds, including the company's line of Genetron refrigerants, aerosol propellants, and industrial chemicals.

Tupper Corp., Farnumsville, Mass., has started construction on a new addition to the Farnumsville plant which will be known as the **Lamothe-Hinchliffe Annex**, in recognition of the efforts of Plant Supt. **George Lamothe** and Production Supt. **Earl Hinchliffe** in increasing production. The new addition, comprising 20,000 sq. ft. of space, will bring local space leased by Tupper up to about 100,000 sq. ft. and will employ over 300 persons when completed.

Other plants are located in Florida, Texas, and Canada. **Earl S. Tupper**, head of the corporation, stated that plans are being made for the construction of another factory in Florida later this year and sale of the Texas plant to get production closer to another Tupper operation.

Eastman Kodak Co., Rochester 4, N. Y., announces that its company has signed an agreement with **Imperial Chemical Industries Ltd.**, England, licensing Eastman Kodak to manufacture and sell polyethylene. Present plans call for the construction of a plant at Longview, Texas,

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with an estimated capacity of 20 million lb. of polyethylene annually.

Sometime ago, Eastman Kodak received certification for rapid tax amortization covering the proposed facilities and has been developing plans for several months. Construction is expected to begin during the summer.

Texas Eastman Co. will operate the polyethylene facilities. Sales will be handled by **Eastman Chemical Products, Inc.**, sales representatives for both the Texas and Tennessee divisions of Eastman Kodak.

The Dow Chemical Co., Midland, Mich., announces that its new plant for production of vinyltoluene will be completed by the end of 1953.

Vinyltoluene behaves chemically in a very similar fashion to styrene and can be used to replace styrene for making new families of synthetic rubber, paint vehicles, rubber reinforcing resins, polyester resins, and molding powders.

Monsanto Chemical Co., St. Louis 4, Mo., announces plans for construction of multi-million dollar facilities for the production of isocyanates.

Monsanto's Plastics Div., Springfield, Mass. announces an expansion of phenolic resin production at its plant in Port Plastics, Ohio. The expansion will add about 15% to its capacity, and is the third expansion program that has taken place since the plant began operation last fall.

The Rex Corp. has recently completed and moved into its new plants, providing 40,000 sq. ft. of floor space on a 25-acre site at West Acton, Mass. There are three laboratories in the new buildings—one for compounding, one for testing, and one for general research. Rex also maintains an engineering department and machine shop capable of designing and making special purpose machines and dies needed in its manufacturing processes.

Erie Resistor Corp., Erie, Pa., has announced plans for the construction of a new plant for the manufacture of plastics and electronic products at Holly Springs, Miss., 40 miles south of Memphis. The one-story building will provide approximately 60,000 sq. ft. of space on a 25-acre tract. The company anticipates production to reach a maximum within two years with a force of about 200 employees.

Cadillac Plastic Co., 15111 Second Blvd., Detroit 3, Mich., has formed a **Fiber Glass Div.**, at a cost approximating $100,000. The new affiliate occupies a 15,000-sq. ft. building at John R and Milwaukee Sts., Detroit. Among equipment already in operation are two 100-ton presses and six other presses running from 10- to 60-ton capacity. The division will also manufacture dies and fixtures for other molders and will warehouse fibrous glass cloth for resale.

Ball Bros. Co., Inc., Muncie, Ind., has announced the consolidation of its **Aridor subsidiary** and **General Cap & Closure, Div. of Jaques Mfg. Co.** The merger of the two companies will combine all manufacturing facilities, with headquarters at 3428 W. 48th Place, Chicago, Ill.

Willard Jaques, president of Jaques Mfg. Co., will serve the new Aridor organization in an advisory capacity. **A. V. Smith**, Aridor's general manager, will be general manager of the combined operation.

Zenith Plastics Co., Gardena, Calif., has increased its plant and offices to include an area of 125,000 sq. ft., with approximately 500 people employed. The largest portion of the new plant area is used for the manufacture of reinforced fibrous glass radomes. Several large parts for the Lockheed W2 Constellation have recently gone into production. Zenith has also formed a **Commercial Development Dept.** which is aimed at expansion of commercial production.

Koppers Co., Inc., Pittsburgh 19, Pa., recently dedicated its new **Williams plant** in Port Arthur, Texas, where it will combine ethylene with benzene to make ethylbenzene. The ethylbenzene is shipped to the Koppers' Kobuta plant, near Monaca, Pa., to be converted into styrene monomer. The plant was started in 1951 and is the sixth plant of **Koppers Chemical Div.**, bringing the total of Koppers' operating installations to 55 plants in 26 states.

Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass., recently dedicated its new research laboratories at 38 Memorial Dr., Cambridge, Mass. Nine separate laboratories are included in the building, which comprises an area of 26,000 sq. ft. of floor space and provides approximately 300 sq. ft. of space for each individual worker.

B. F. Goodrich Chemical Co., Cleveland 15, Ohio, has announced that the company will build a new acrylonitrile plant at Calvert City, Ky., next door to its recently finished vinyl chloride monomer plant. Completion of the new unit is set for late 1954 with an annual capacity of 24 million pounds. **Thomas B. Nantz** will be plant manager of both plants.

It is anticipated that Goodrich will use a large portion of the new plant's capacity in its own Hycar nitrile rubber; in polyblend, which is a combination of vinyl chloride and acrylonitrile compounds; and in soil conditioners. Acrylonitrile is also widely used in the production of synthetic fibers.

COMPANY NOTES

Catalin Corp. of America has elected **Edward W. Bastian** a vice president at a Board of Directors' meeting. He will act as general sales manager with headquarters at the executive offices, 1 Park Ave., New York, N. Y. Mr. Bastian joined the organization in 1945.

Du Pont's Polychemical Dept. has revamped its sales and service departments by separating technical service from new products and applications development. **Henry M. Cadot**, assistant section manager, assumes primary responsibility of sales development; **Herbert S. Lecky**, formerly a superintendent at the company's **Sabine River Works** near Orange, Texas, has been made assistant manager of sales service; and **Doyce B. Hanson**, formerly a product specialist, is now in charge of the sales service laboratory.

Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y., announces the election of **Howard S. Bunn** as vice president. He has been president of **Bakelite Co.**, a Div. of

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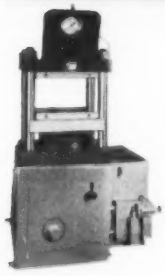

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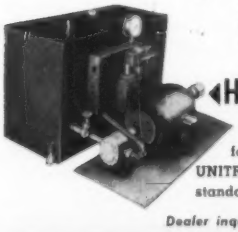

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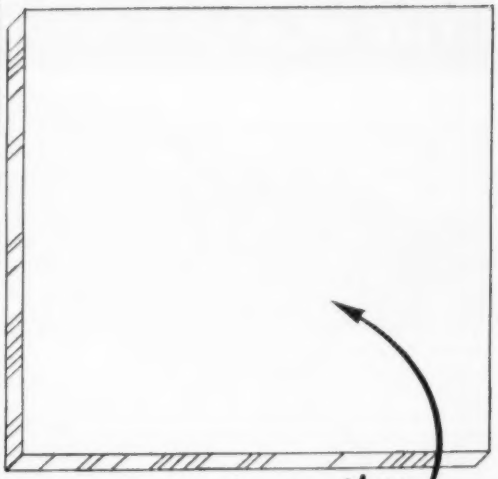

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THE PLASTISCOPE

Union Carbide and Carbon, since May 1952. Mr. Bunn is also a director and president of **Bakelite Co. (Canada) Ltd.**, a director of **Bakelite Ltd. (England)**, and a director and vice president of **Canadian Resins and Chemicals Ltd.**

Mr. Bunn joined the Carbide organization in 1922 as a salesman of alloy specialties for the chemical industry. Subsequently, he was appointed advertising manager of Carbide and Carbon Chemicals Co. and then manager of its **Pyrofax Div.** In 1938 he was made manager of the **Plastics Div.** and in 1944 vice president of the division and vice president in charge of sales of **Thermoplastics Div.**, Bakelite Co.

St. Regis Paper Co.'s Panelyte Div. has named **Charles L. Walters** sales manager for decorative Panelyte in the United States, with headquarters in New York. Mr. Walters will also remain in charge of all Panelyte sales in Canada.

Flexible Products Co., P. O. Box 306, Marietta, Ga., is the new name of the organization formerly known as **Plastex Products Co.**

Pennsylvania Industrial Chemical Corp., Clairton, Pa., announces the appointment of **Jack L. Wilson** as director of sales. He will continue to serve as assistant to the president.

Flek Corp., 2252 E. 37th St., Los Angeles 58, Calif., has been named exclusive warehousing distributor for Kel-F molding powders on the West Coast by **The M. W. Kellogg Co.**, Jersey City, N. J.

Tracerlab, Inc., 130 High St., Boston 10, Mass., has opened two branch offices in Atlanta, Ga., and Cleveland, Ohio, for the convenience of customers using its beta gage in those areas. **Keith Elrod** will manage the Atlanta office at 1844 Stanton Rd. and **William A. McCarthy**, the Cleveland office at 4614 Prospect Ave.

George Woloch Co., Inc., 82 Beaver St., New York 5, N. Y., has moved its plant from Elizabeth, N. J., to larger quarters in Kenilworth, N. J. The company reports that production facilities have been doubled for reprocessing polystyrene, polyethylene, acetate, and butyrate. Facilities have also been increased for custom work of pelletizing or grinding a manufacturer's own material and coloring it to specifications.

Swedlow Plastics Co., 5527 District Blvd., Los Angeles 11, Calif., has acquired the facilities, personnel, methods, techniques and engineering services of **Sierra Products Co.**, 1632 E. Compton Blvd., Los Angeles. Sierra has for the past five years been engaged in developing production techniques for the fabrication of Sierracin polyester materials.

The Dow Chemical Co., Midland, Mich., has appointed **Sherman W. Putnam Organization, Inc.**, Chicago, Ill., a distributor for Styrofoam.

Celanese Corp. of America's Plastics Div. has established a Cleveland, Ohio, district sales office in the Hanna Bldg., 1422 Euclid Ave., with **Karl W. Kithill** in charge. The new district headquarters replaces the branch office in Detroit, Mich. The Cleveland office will handle the sale of the company's plastic films, sheeting, and molding materials in Ohio, Michigan, W. Virginia, eastern Kentucky, western Pennsylvania, and western New York.

Celanese also announces the following appointments: **R. B. Carter** has been named assistant director of sales for the **Sheet and Molding Materials Dept.**, located at 290 Ferry St., Newark, N. J. **Charles M. Reynolds** and **Richard M. Leiter** have been appointed assistant district managers, with headquarters at 1514 Merchandise Mart, Chicago, Ill., and 180 Madison Ave., New York 16, N. Y., respectively.

Erie Resistor Corp., Erie, Pa., has named **E. Charles Smith** as representative of its **Plastics Div.** for the Indiana and Ohio territory and **Walter J. Brosman** as representative for the Philadelphia, Pa., and New York territory.

Calresin Corp., Arcadia, Calif., and Ottumwa, Iowa, has purchased **Poly-Fiber, Inc.**, Los Angeles, Calif., a subsidiary of **Dumont**, 4545 Brazil St., Los Angeles. Poly-Fiber operates as a reinforced plastics molding and fabricating plant.

Harte & Co., Inc., 267 Fifth Ave., New York 16, N. Y., announces that it now has a line of over 30 new patterns for application in the field of vinyl sheeting.

Clopay Corp., Cincinnati 14, Ohio, is now occupying new sales showroom offices in Suite 301, 230 Fifth Ave., New York 1, N. Y., under the direction of **Harry Olson.**

The Goodyear Tire & Rubber Co. Inc., Akron 16, Ohio, announces the following appointments: **John E. Warner** has been named district manager of the **Chemical Div.'s** St. Louis office and **Robert E. Kann**, district manager for the Chicago area. **W. A. Boudry** and **Clark E. Hixson** have been appointed senior staffmen of Goodyear's **Pliofilm Sales Dept.**

Pittsburgh Plate Glass Co., 632 Duquesne Way, Pittsburgh, Pa., has appointed **Michael J. Batenburg** to the newly created position of general advertising manager and **Richard W. Dittmer** as assistant director of public relations. **John H. Clark** has been named sales representative of the New York district sales office of the company's **Fiber Glass Div.**

Davis-Standard Sales Corp., Mystic, Conn., has been organized to assume the exclusive marketing of Davis-Standard extruders and Standard molding presses which are manufactured by **The Standard Machinery Co.**, Mystic, Conn. Standard Machinery started to produce molding presses in 1936 and to date has delivered 1500 presses. The company has more recently added extruding machines to its line. Standard molding presses were formerly sold through **F. J. Stokes Machine Co.**, Philadelphia, Pa., under the name of Stokes Standard molding presses, but will now be available directly through Davis-Standard Sales Corp.

U. S. Rubber Co. announces the installation of a 28- by 66-in. 4-roll calender and auxiliary equipment in the company's Mishawaka, Ind., plant.

Clifton Hydraulic Press Co., 290 Allwood Rd., Clifton, N. J., has been established for the manufacture of hydraulic presses. An export office is maintained at 44 Whitehall St., New

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York, N. Y. A 36-page illustrated catalog is available upon request to Clifton.

Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill., has opened the following new branch offices: 338 E. 25th St., Baltimore 18, Md.; 435 Newtonville Ave., Newtonville 60, Mass.; 2561 N. Clark St., Chicago 14, Ill.; 1951 Richmond Ave., Houston 6, Texas; 66 Hudson St., Hoboken, N. J.; 1433 W. Erie Ave., Philadelphia 40, Pa.; 1300 Rock St., Rockford, Ill.; 3714 Fourteenth Ave., Rock Island, Ill.; 1011 Ridgely Bldg., Springfield, Ill.; and 6693 Park Ave., Montreal 15, P. Q., Canada.

Hercules Powder Co., Wilmington 99, Del., announces the election of **Albert E. Forster** as its new president and chairman of the executive committee, succeeding **Charles A. Higgins** who has resigned but will continue as chairman of the board. Mr. Forster joined the company in 1925, has been a director since 1940, and vice president and member of the executive committee since 1951.

W. C. Hardesty Co., Inc., 41 E. 42nd St., New York, N. Y., has announced the addition of sodium epoxystearate to its line of products. The sodium salt is suggested as a stabilizing agent for polyvinyl chloride and other halogenated products.

Logo, Inc., 13799 S. Avenue O, Chicago 33, Ill., a subsidiary of **Bee Chemical Co.**, announces the development of a new Logoquant frost coating for application to the reverse side of clear polystyrene or acrylic. It is claimed to be the first time that the irridescence of frost crystals has been achieved for thermoplastics. Major use of the coating will be in refrigerators, deep freeze units, and other low-temperature applications.

M & N Hydraulic Press Co., formerly **M & N Machine Tool Works**, has moved into its newly built plant at 780 Route #3 Clifton, N. J.

Chester Packaging Products Corp., 284 Nepperhan Ave., Yonkers, N. Y., announces that **Winfield E. Channing** has been named sales and promotion manager. He will direct sales of Cheslene polyethylene film to packaging converters and supervise the distribution of the company's new treated film, Cheslene TF, from 295 Madison Ave., New York, N. Y. **B. Richard Whitehill** has been made general manager of Chester's newly formed subsidiary, **Cheslam Corp.**, operating from the Yonkers address. The new division specializes in the research, production, and sales of laminates, and combinations of extruded polyethylene with other flexible materials.

Riverdale Plastics Development Corp., 423 Third St., Jersey City 2, N. J., has brought out a new line of dry colors for all thermoplastic materials. Standard colors are available from stock and matches for special colors or effects such as metallic, fluorescent, and pearlescent are available upon request.

Arthur GeWertz, 521 Fifth Ave., New York, N. Y., will handle the company's line of colors in the New York and New England areas and **John G. Simmons, Plastic Equipment Co.**, Box 302, Ridgewood, N. J., in New Jersey and eastern Pennsylvania.

Koppers Co., Inc., Pittsburgh 19, Pa., has appointed **H. C. Carlson** as chemical products manager of its **Chemical Div.'s Sales Dept. L. R. Hunter**, former Pittsburgh district sales representative of the division, succeeds Mr. Carlson as Midwestern district sales manager.

F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia, Pa., has named **J. William Robinson** manager of the company's new Canadian branch located at 1179 Decarie Blvd., Montreal 9, Quebec.

General Electric Co.'s Chemical Div. has established a new warehouse service at 840 S. Canal St., Chicago, Ill., and plastic molders in that city can now obtain over-night delivery on G-E phenolic molding compounds.

Bjorksten Research Laboratories, Madison, Wis., reports that **Risto P. Lappala** has been promoted from research chemist to group leader and **Charles A. Barth, Jr.**, and **Clarence N. Ferguson** have joined the organization. Mr. Lappala will direct research on non-woven sheet materials especially suited to packaging of drugs and foods; Mr. Barth will develop metallized synthetic materials for thermally protective packaging applications; and Mr. Ferguson will do exploratory research on glass-filled plastic film.

Wilson Plastics, Inc., Sandusky, Ohio, has named **Traffic Floor Covering Co.**, 2716-26 Penn Ave., Pittsburgh, Pa., as distributor for Wilson Lockback and Wilson Econ-O-Tile in the Pittsburgh area.

Fiber Glass Div., Libbey-Owens-Ford Glass Co., announces the appointments of the following distributors: **Cork Engineering & Insulation Co.**, 57 Braintree St., Boston, Mass., to service Maine, Vermont, New Hampshire, Massachusetts, and Rhode Island; **Houston-Starr Co.**, 300 Brushton Ave., Pittsburgh, Pa., for the tri-state area; **Parkersburg Ice & Fuel Co.**, Ft. of Sixth St., Parkersburg, W. Va., to cover W. Virginia and several counties in Ohio; **Roe-James Glass Co.**, Ninth & Robert Sts., St. Paul, Minn., to market the Northwest.

Fiber Glass Div., has also made the following new assignments: **Thomas L. Carver**, New York district sales manager; **Arthur S. White**, field representative in St. Louis industrial area; and **Edward A. Turner**, sales representative for Chicago area.

Plax Corp.'s Chicago office is now located at 59 E. Van Buren St.

PERSONAL

William J. Smythe, formerly with **Monsanto Chemical Co.**, has joined **Elastomer Chemical Corp.**, 212 Wright St., Newark 5, N. J., as technical service manager.

H. Roger Coleman is now development director of **R. S. Aries & Associates**, 400 Madison Ave., New York 17, N. Y. He was formerly connected with **Evans Chemetics, Inc.** and the **Special Products Div.** of **General Aniline & Film Corp.**

J. S. Stanford has been appointed assistant to the president of **Varcum Chemical Corp.**, Niagara Falls, N. Y., with complete charge of operations at the company's Niagara Falls and Lindsay, Ontario, plants. **Mr. Stan-**

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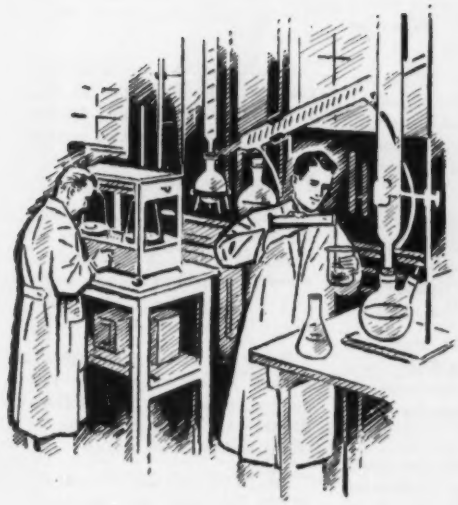

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100, 50, 25 lb. fiber drums.

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ford was formerly with **The Borden Co.'s Chemical Div.** and **Monsanto Chemical Co.'s Plastics Div.**

Chase Donaldson has been elected president of **East Coast Aeronautics, Inc.,** Pelham Manor, N. Y., a subsidiary of **Barium Steel Corp.,** 25 Broad St., New York 4, N. Y.

Jerold L. Welch has been appointed assistant chief engineer of **Reed-Prentice Corp.,** Worcester 4, Mass.

Prescott F. Huidekoper, formerly sales representative of **Plaskon Div., Libbey-Owens-Ford Glass Co.,** has been named sales manager of **Shaw Insulator Co.,** 160 Coit St., Irvington 11, N. J.

George C. Miller has been appointed president of **Bakelite Co.,** a **Div. of Union Carbide and Carbon Corp.,** 30 E. 42nd St., New York 17, N. Y. He succeeds **H. S. Bunn,** vice president of Union Carbide, who now succeeds the late **J. W. McLaughlin** as chairman of Bakelite and as a member of the **Appropriations Committee** of Union Carbide. After attending Daniel Baker College, Brownwood, Texas, Mr. Miller joined **Linde Air Products Co.,** a Div. of Union Carbide, in 1922 and was subsequently transferred to **Carbide and Carbon Chemical Co.'s** development work on plastics. In 1944, he became general sales manager of Bakelite's **Thermoplastics Dept.,** and vice president in charge of sales for Bakelite in June 1952.

Gustavus J. Esselen III, Warwick Rd., Mountain Lakes, N. J., has been appointed New York sales representative for **Pittsburgh Coke & Chemical Co.'s Plasticizer Div.,** Pittsburgh, Pa.

Paul A. Roush, senior project engineer of **Flexible Tubing Corp.,** Guilford, Conn., has been appointed product development manager of the company. A physicist and specialist in high temperature polymers, Mr. Roush will have charge of Flexible's research, product development, and quality control activities. He was formerly with **B. F. Goodrich Co.** for 17 years.

Raymond F. Clark, vice president in charge of the industrial products division of **Hess, Goldsmith & Co., Inc.,** 1400 Broadway, New York, N. Y., has been elected a director of the company.

Albert M. Stover, formerly manager of Marvinol plastics development, is now assistant to the director of research and development of **U. S. Rubber Co.'s Naugatuck Chemical Div.,** Naugatuck, Conn.

Clyde C. West has joined **Specialty Resins Co.,** 2801 Lynwood Rd., Lynwood, Calif., as technical sales manager. Mr. West was formerly director of research of **U. S. Industrial Chemicals, Inc.,** Newark, N. J.

Martin E. Conroy has joined the technical sales staff of the **Chemical Mfg. Div.** of **The M. W. Kellogg Co.,** Jersey City, N. J. He was formerly associated with **General Electric Co.'s Chemical Div.**

David W. Towler has established an office at 419 Boylston St., Boston 16, Mass., and will handle the sale of Kel-F for **The M. W. Kellogg Co.,** Jersey City 3, N. J., in that state.

C. L. Garner has been appointed sales manager of **Tube-Kote, Inc.,** Houston, Texas, manufacturers of corrosion-resistant linings for tubular equipment.

Dr. George Gerard has been made consultant of **Bassons Industries Corp.,** 1432 W. Farms Rd., New York 60, N. Y. He was formerly an assistant professor of aeronautical engineering and is now in charge of research projects at New York University. He was previously affiliated with **Republic Aviation Corp.** as principal research engineer.

Frank J. McLeod, 752 Inwood Ct., Maumee, Ohio, has entered the plastics and allied industries as a consultant and manufacturer's representative. Mr. McLeod was formerly sales manager of the **Textile Div., Glass Fibers, Inc.,** Toledo, Ohio.

John Conway is now assistant sales manager of industrial chemicals of **Carbide and Carbon Chemicals Co.,** 30 E. 42nd St., New York 17, N. Y. Mr. Conway joined the company in 1935.

Donald H. Kocher has been promoted to branch manager of the Detroit sales office of **Monsanto Chemical Co.'s Plastics Div.**

Edward E. Stritter has been made plastics development manager of **Boston Woven Hose & Rubber Co.,** P. O. Box 1071, Boston 3, Mass. Mr. Stritter has been with the company 17 years, the last four as assistant technical superintendent.

W. Dennis Barton has joined the executive sales staff of **Alsynite Co. of America,** 4670 DeSoto St., San Diego, Calif. He was formerly owner and manager of **Consolidated Plastics,** Danville, Calif. Mr. Barton will continue to make his headquarters at Danville, where Alsynite will open a regional sales office for 11 Western states.

Robert Bostwick, formerly associated with **Bakelite Co.** at Bound Brook, N. J., has joined **Irvington Varnish & Insulator Co.,** Irvington, N. J., as a research chemist in the **Fibron Division.**

Robert D. Jones has been named Pacific regional sales manager of the **Corrulux Div. of Libbey-Owens-Ford Glass Co.** with headquarters at 1101 Tishman Bldg., 3440 Wilshire Blvd., Los Angeles, Calif.

Harry G. Lake, back from the Armed Forces, has been re-appointed to the **Sales Div. of General Electric Co.'s Plastics Dept.,** with offices in Cleveland, Ohio.

Eric L. Strauss has joined the staff of the **Research and Development Laboratory** of **Taylor-Wharton Iron and Steel Co.,** Easton, Pa. The laboratory is working on the development of fibrous glass reinforced plastics cylinders and Mr. Strauss will participate in the project.

Deceased

James W. McLaughlin, vice president of **Union Carbide and Carbon Corp.,** 30 E. 42nd St., New York 17, N. Y., died suddenly on May 15.

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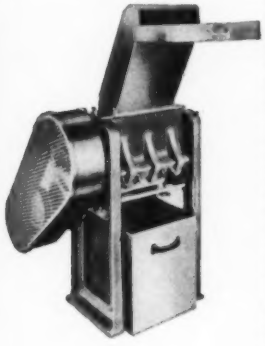	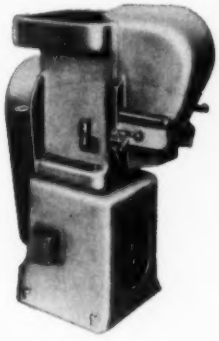	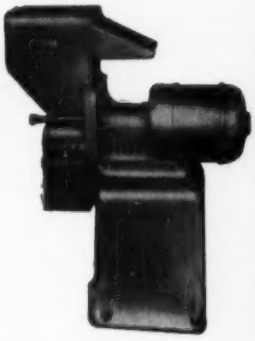
Simple, rugged and highly efficient. Has capacity of 200 lbs. per hour. 3 H.P. Motor with double V belt and Meehanite flywheel. Features high grade roller bearings with positive seal. Four cutting blades placed on a bias permit efficient cutting of thin strips in Vinyl, Saran, etc. Standard screen with ¼" openings (other screen sizes on request). Floor space required 32" x 44"; net weight with motor (approx.) 800 lbs.	For low-cost salvage of the large slugs and chunks resulting from cleaning out the heating cylinder, accumulation at the nozzle and also those molded pieces too tough for the average sprue and scrap grinder. Capacity — Over 150 lbs. per hr. 3 H.P. Motor in Base. Double V Belt Drive. Heat treated Alloy Steel Rotor High Grade Roller Bearings with Positive Seals. Standard Screens with 11/32" Openings (other sizes on order).	Recommended for at-the-machine operation. Available with or without base. Capacity 75 lbs. per hour, 2 H.P. Motor 1200 RPM; Direct spline drive; Solid semi-steel hopper; High grade roller bearings with positive seals; Standard screen with 11/32" opening; Overall dimensions 34" long, 12" wide, 23½" high (from bench); Hopper opening 9" by 4½"; Net weight 375 lbs. without base; 500 lbs. with base.

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EMPLOYMENT • BUSINESS OPPORTUNITIES • EQUIPMENT (used or resale only)

MACHINERY and EQUIPMENT FOR SALE

HYDRAULIC PRESSES—SPECIAL OFFERINGS—IMMEDIATE DELIVERY: 1—Clearing 500 Tons, completely self-contained with controls for manual or automatic operation, suitable for compression and injection molding. 1—Farrell, 390 Tons, 48"x48" steam platens, 2 openings, 4 rams-10" diam. x 24" stroke, approx 15" per opening. 1—Loomis (New), 340 Tons, down-acting, 56"x24" steam platens, 2—rams 12" dia. x 10" stroke, adjustable DLO 2½" to 20½". 1—Watson-Stillman, 100 Tons, 11¾"x12" platens, 22½" DLO, ram 8" dia. x 15" stroke. 1—Watson-Stillman, 100 Tons, down-acting, 22"x20" bed area, 24" DLO, ram —11½"x9½"x6" stroke, self-contained; complete with 15 HP motor driven Vickers pump, all valves, piping, controls. Unit is practically new. 1—HPM, 100 Tons, 18"x18" Platen area, Ram 8" Dia. x 18" Stroke, 36" DLO, Steel Cylinder—4000 PSI. 2—Burroughs, 75 Tons, down-acting, 17p"x17" electric-heated platens, 13½" DLO, ram 8" diam. x 10" stroke, complete with 7½ HP Motor-driven Oilgear Pump, all piping, valves, controls. 1—Loomis (New), 50 Tons, down-acting, 56"x24" electric-heated platens, 2 rams—6" diam. x 12" stroke, adjustable DLP 2½" to 20½". 1—Watson-Stillman, 50 Tons, down-acting, platen area 25"x 25½", 25" DLO, ram 8" dia. x 14" stroke, complete with 7½ HP Motor-driven Pump, valves, piping, controls. 1—New Laboratory Press, 12 Tons, Hand Operated, fitted with 8"x8" electrically heated platens. 3—Denison, 4-tons, model FH4-CO1, down-acting ram 3¼"x2"x12" stroke, 18" DLO, bed area 22"x14", 8⅛" throat, complete with 3 HP motor driven pump, time delay control, all valves, piping, gauges, controls, 1 machine set up, but never used in production. 2 units still in original crates. 1—Standard Machinery Co. 214 Toggle Press, 150 Tons, platen area 14"x28"—6" DLO, 3½" Stroke, arranged for Motor Drive, practically new. ALSO JUST ACQUIRED: 1—Hartig 2" Plastics Extruder, 3-Stage Oil Heating, Complete with 7½ HP Motor, Drive, Full Set of Controls. 1—Hartig 3¼" Plastics Extruder, 3-Stage Oil Heating, Complete with 15 HP Motor, Drive, Full Set of Controls. 1—Allen-Williams Rapido 6" Strainer—Suitable for Rubber or Plastics—Herringbone Drive Gears, complete with V-Belt Drive and 50 HP Burke Slip Ring Motor and Controls. Excellent condition. 1—Banbury No. 1 Mixer. Complete with 50 HP Motor and Drive. Recently completely rebuilt. All working surfaces Hard Chrome Plated. New rolled steel steam platens and new end bells. HELI-SHAW Rotary Pumps, various sizes. JOHNSON MACHINERY COMPANY, 683 Frelinghuysen Avenue, Newark 5, New Jersey. Bigelow 8-2500. What have you for sale? What are you looking for?

FOR SALE: Quick delivery Rubber and Plastic Equipment. Farrell 16"x48", and 15"x36", 2 roll rubber mills. Other sizes up to 84". New Seco 6"x12" and 6"x16" Lab. Mixing Mills and Calenders. Rubber & Plastic Extruders. W. S. 350 ton downstroke Hydr. Press, 30"x30" Platens self contained. 200 ton Brunswick 21"x21" Platens, 14" Ram, Record Presses. Wat.-Still. 100 ton 24"x24", Elms 75 ton 30"x 36". Also presses Lab. to 2000 tons from 12"x12" to 48"x48". Hydr. Oil Pumps. Goulc 75 HP motor Dr. 3 stage Centrif. Pump. 250# W.P. W.S. 4 Plgr. High and Low Pressure Hydr. Pump. HPM 5 GPM 2700 lbs. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & Single Punch Preform Tablet Machines ½" to 3". Injection Molding Machines 1 oz. to 32 oz Baker Perkins Jacketed Mixers 1 0, 50, and 9 gal. Plast'c Grinders. Heavy duty mixers, grinders, pulverizers, gas boilers, etc. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 107-8th Street, Brooklyn 15, N. Y., STerling 8-1941.

WE HANDLE HYDRAULIC PRESSES, pumps and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. HYDRAULIC SAL-PRESS, INC., 386-98 Warren Street, Brooklyn 2, N. Y. MAin 4-7847.

FOR SALE AT GREAT SAVINGS: Colton 2 and 3 RP Rotary & 4T Tablet Machines. Mikro (S.S. also), 1SH, 2TH, 3TH, 4TH Pulverizers; Schutz O'Neill Mills. Baker Perkins & Readco Heavy Duty Steam Jacketed, Double Arm 50, 100, 150 gal. Mixers. Baker Perkins 150 gal. D.A. Unidor Jacketed Mixer. Baker Perkins 100 gal. D.A. Vacuum Mixers. J. H. Day, from 8 up to 75 gal., Imperial and Cincinnatus D.A. Jacketed Sigma Blade Mixers. Day & Robinson 100 up to 10,000 lbs. Dry Powder Mixers. Abbe Engineering #10 Rotary Cutter. Package Machy. FA, FA4, Miller, Hayssen 3-7, Scandia auto. Wrappers. Hudson Sharp Campbell auto. Cellophane Wrapper. Rebuilt and Guaranteed. This is only a partial list. Over 5000 machines in stock—available for immediate delivery. Tell us your machinery requirements. UNION STANDARD EQUIPMENT CO., 318-322 Lafayette St., New York 12, N. Y.

SAVE WITH GUARANTEED REBUILT EQUIPMENT—RUBBER MIXING MILL, heavy duty 18"x48"; HYDRAULIC PRESSES: 28"x25", 750 ton, 18" ram. HOBBING, 26"x18", 12" main ram, TRANSFER, 170 tons; 20"x20", 10 ram 118 tons, 24"x20", 10" ram, 118 tons: 20"x20", 10" ram, 200 tons, 30"x20" 8" ram, 75 tons, 15"x15", 8" ram, 75 tons, 19"x24", 10" ram, 78 tons, 12"x12", 6½" ram, 50 tons, 14"x14", 8" ram, 50 tons, 8"x8½", 4½" ram, 20 tons, 16"x16", 3½" ram, 12 tons; LABORATORY PRESSES: Carver, model 150, 10 ton, Buehler 10"x7" 12 ton; NEW UNIVERSAL DUAL PUMPING UNITS: 3 to 15 HP; NEW LABORATORY MILLS & CALENDERS; EXTRUDERS: Royle #1 Plastic, insulating type, NRM, 6", strainer type; ACCUMULATOR HPM 6" ram, 2500#, PREFORM PRESSES all sizes, also Mixers, Vulcanizers, Injection Molding Machines, etc. UNIVERSAL HYDRAULIC MACHINERY CO., INC., 285 Hudson St., New York 13, N.Y.

FOR SALE: 1—6"x12" Lab. Roller Mill; 1—Baker Perkins Banbury type 10 gal. Mixer, with pressure cover, m.d.: 1 Bolling 18"x18" 5-opening Hydraulic Presses; 1—HPM 4-oz. Injection Molding Machine; 2—Ball & Jewell Rotary Cutters; 1—100 gal. Patterson Kneadermaster S/S Mixer; 1—Eureka Rotary Cutter; 1—500 gal. Patterson Reaction jack. agit. Resin Kettles; 7—Dry Mixing Blenders, up to 11,000#'s; 1—NRM 1" electric heated Plastic Extruder; 2—Day Roball 82 Sifters, 40"x120" screens; 2—Rotex #12, 20"x37" screens; 1—Retex 30"x48" Sifter; 3—Mikro Pulverizers 2TH, 3TH, 2DH. Also Grinders, Extruders, Compression and Injection Molding Presses, etc. Send us your Inquiries. Advise us what you have for sale. CONSOLIDATED PRODUCTS CO. INC., 13-14 Park Row, New York 38, N. Y. BArclay 7-0660.

FOR SALE: 28 Ton WS 18"x18" Platen. 50 Ton PRESS 20"x20" Pl., 75 Ton ADAMSON PRESS 20"x20" Pl., 75 Ton WS 15"x15" Pl., 140 Ton WS 22"x17" Pl., 150 Ton HPM Triple Action 36"x36" Pl. 175 Ton HPM 30"x30". 250 Tons WS 28"x24". 300 Ton WS 20"x20". 300 Ton WS 24"x29" Platen. 8-oz. WS, 9-oz. HPM. 4 oz. DeMattia Injection Molding Machines. Accumulators. Laboratory Presses, Pistons & Oil Pumps. Pulverizers. Scrap Cutters. Grinders, Ball & Jewell, Cumberland, AAMON MACHINERY CO., INC., 45 Crosby St., New York 12, N. Y. WOrth 4-8233.

FOR SALE: Reinforced Plastics Presses 54"x 144", 30"x60". Injection Presses: 4 & 9 oz. HPM, 6 oz. Watson, 8 oz. Lester, 16 oz. Impco VFS22, 1 oz. VanDorn, 8 oz. Reed. Extruders: 1½" & 3½" NRM, Royle No. 1 Wire cov. unit, 1¼" MPM w. crosshead. 1—Royle Oil Heater. Conveyor 22'x12". Scrap grinders, Ovens. Transfer & Compress. Presses. Preform presses: Colton 5½ T, Stokes 280 C, Kux No. 25. Sheridan Embosa. press No. 9, 42" Slitting & Rewind. machine. 3 HP Gasboilers. List your equipment with me for prompt action. JUSTIN ZENNER, 823 Waveland Ave., Chicago 13, Ill.

FOR SALE: One Polyethylene Flat Sheet Take-Off Unit. Completely automatic roll change rewind with electronic tension control. End Trim Slitters with trim disposal unit. Stainless steel water bath unit. Both 60 inches wide. Manufactured by Progressive Machine Company. Used for test runs only. Original cost $10,000. Best offer will be accepted. Reply Box 708, Modern Plastics.

PARTIAL LIST of available machines, may be inspected in operation: 4 ounce New, our own machine. 60 ounce Jackson & Church, new 1950. 48 ounce DeMattia w/preplasticizer. 48 ounce Lester, almost new. 24 ounce Reed-Prentice 1947. 22 ounce Impco vertical. 12 ounce Lester, $10,000. 12 ounce Reed-Prentice. 12 ounce Fellows-Leominster, new 1950, $17,500. 8 ounce Watson-Stillman, 1944, $7,000. 6 ounce Reed-Prentice, new 1938. 4 ounce Impco Horizontal, 1951. 3—50 Ton Hydraulic presses for records. 3 ounce Fellows, 2 years old. 2 ounce Watson-Stillman vertical. Vacuum Plating machine 4' rotary. We also have available several compression, transfer and preform presses. ACME MACHINERY & MFG. CO., P.O. Box 731, 102 Grove St., Worcester, Mass.

UNUSUAL OFFERING: 1—Akron Standard Mold Co. MacBeth Hydraulic-Mechanical Toggle Press. Nominal Rating 450 Tons—Last Operated at 520 Tons—Platen Area 38"x38", Complete with 7½ HP Motor Driven Vickers Pump System. Full Controls For Automatic Or Manual Operation. High Speed Production Unit. Further Complete with Steam Heated Molds: 1—33 Cavity for 4" Long Neck Force Cups. Excellent condition—Inspection under Power. JOHNSON MACHINERY COMPANY, 683 Frelinghuysen Avenue, Newark 5, New Jersey. Bigelow 8-2500. What have you for sale? What are you looking for?

FOR SALE: 1—Ball & Jewell No. 1½ Rotary Cutter, stainless steel. 4—Mikro Pulverizers #1-SH, #1-SI, #2-SI, #2-TH. 2—Kux Rotary Pellet Presses. 4—Stokes D-3 Rotary Pellet Presses. Read 600 lb. Jacketed Ribbon Mixer. Large stock Stainless Steel Tanks and Kettles. PERRY EQUIPMENT CORP., 1429 N. 6th St., Phila. 22, Pa.

FOR SALE: 2 Watson-Stillman Injection Molding Machines complete with instruments. Both in good condition and both can be seen in operation. 1—4 ounce $3,300. 1—6 ounce $3,600. BACHMANN BROS., INC., 1400 E. Erie Avenue, Phila., Pa.

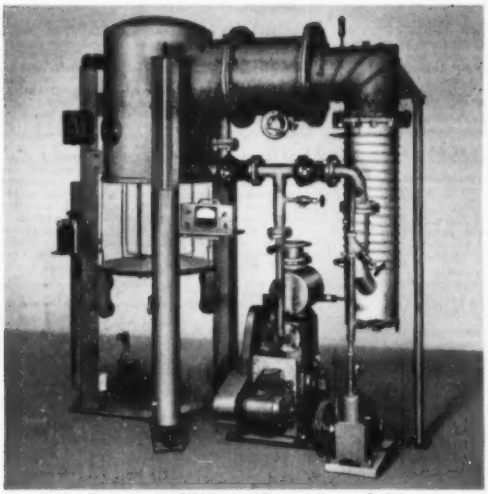
REED PRENTICE eight ounce and Monson Engineering twelve ounce injection molding machines for sale. Being replaced by larger equipment. Machines may be inspected in operation. F. R. SCHREITER, INC., 179 Brook St., Clinton, Mass.

FOR SALE: 1—9 oz. HPM Injection molding machine Hydro-Power, Oil Heated Chamber Power Screw Feed 200 Ton Clamp new 1940. 1—12 oz. HPM—same characteristics as above Priced for quick sale. STEWART BOLLING & COMPANY, INC., 3190 E. 65th St., Cleveland 27, Ohio.

TANKS FOR SALE—Tank Car Shells, five (5) 8000 gallon capacity—Two (2) 7000 gallon —Riveted—with coils—good condition—used for Vegetable Oil Storage—Price $500.00 each—F.O.B. our Plant. Contact H. P. Demerjian, BAKER CASTOR OIL CO., 40 Ave. "A", Bayonne, N. J.

FOR SALE—Slightly used, 30 ton Elmes Hydraulic Laminating Press, 12x12 Thermatic Controlled, and water-cooled platens, $500.00 F.O.B. Denver. AEROPLANE TACKLE MFG. COMPANY, 748 Lincoln St., Denver, Colorado.

(Continued on page 202)



The new model 3111 National Research Vacuum Coater

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$6350* COMPLETE — READY TO OPERATE

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If your vacuum metallizing production has outgrown the bell-jar stage, here's your answer. A new, low cost coating unit complete with Alphatron® gauging, jigs with manual rotator and filament power supply. It swiftly coats plastics or metal surfaces with a gleaming layer of metal.

Simple to operate. All loading, unloading and operating is done at a single station. Equipped with NRC Rotary Gas Ballast Pumps that maintain initial cfm rate even when pumping water vapor, plus a 10-inch diffusion pump. Pump down time to coating pressure is approximately 4 to 5 minutes with the tank dry and empty. Tank size 24 inches in diameter, 30 inches high. Write for details.

*F. O. B. Newton, Mass.

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on The *FINEST* EJECTOR PINS Made!

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- HOT-FORGED HEAD for Added Strength
- NITRIDED CASE for Longer Wear
- ANNEALED HEAD that CAN BE DRILLED
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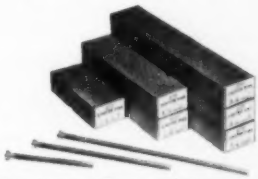

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CLEVELAND 14, OHIO	5473 LAKE CT.	ENDICOTT 1-0907
LOS ANGELES 7, CAL.	3700 SOUTH MAIN ST.	ADAMS 3-8214

CLASSIFIED ADVERTISING

(*Continued from page 200*)

GENERATOR (USED) FOR SALE: RCA Model 15-B Dielectric Preheating R. F. Generator, complete with 3 phase Plate Power Transformer. Reply MOLDED PRODUCTS, 4533 West Harrison, Chicago 24, Illinois.

OFFER One Modern 18x42" Farrel Plastic Mill, Complete. Reply Box 721, Modern Plastics.

FOR SALE: 20 oz. Lester-Phoenix injection molding machine—late 1949 model. 48 oz. DeMattia injection molding machine used only 8 months—complete with pre-plasticizer. Reply Box 739, Modern Plastics.

MACHINERY and EQUIPMENT WANTED

WANTED: Banbury Mixers, Heavy Duty mixers, Calenders Rubber Rolls & Mixers. Extruders, Grinders & Cutters. Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider an operating or shut down plant. P. O. Box 1351, Church Street, New York 8, N. Y.

WANTED: Plant or Machinery including Rubber Mills, Hydraulic presses, Sturdy mixers, Calenders, Banbury mixers, Pulverizers, Grinders, Rotary cutters, Extruders, Screens, Injection Molding machines, Dryers. CONSOLIDATED PRODUCTS CO. INC., 13-14 Park Row, New York 38, N. Y. BArclay 7-0600.

Wanted: 8 Ounce Lester injection molding machine in good operating condition. Prefer to see in operation. Prefer location in nearby or neighboring States. State year, model, related equipment and price. CITY PLASTICS CORP., 111 Roosevelt Ave., Mineola, L.I., N. Y. Tel: GArden City 3-5242.

WANTED—4 ounce HPM Gravity Feed Injection Molding Machine. Must be late model in good operating condition. Contact NATIONAL PRODUCTS COMPANY, 6100 Wilson Avenue, Kansas City, Missouri.

WANTED: Plastic injection moulding machines. Get our offer before you sell. ACME MACHINERY & MFG. CO., 102 Grove St., Worcester, Mass.

WANTED: Used Plastic Grinder, capacity 500 lbs. or more per hour. Forward full details, including photograph if possible, and price. P. O. Box 1068, Erie, Pa.

WANTED: 50 Ton Stokes Standard Automatic Molding Press. Reply Box 732, Modern Plastics.

MATERIALS WANTED

WANTED: PLASTIC SCRAP OR REJECTS in any form. Also surplus and obsolete lots of virgin molding powders. We also custom reprocess your own scrap. A. BAMBERGER CORP., 703 Bedford Ave., Brooklyn 6, N. Y. Telephone: MAin 5-7450.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate, Custom grinding, magnetizing, compounding, and straining of contaminated plastics. FRANKLIN JEFFREY CORPORATION, 2004 McDonald Avenue, Brooklyn, N. Y., ES 5-7943.

WANTED: PLASTIC SCRAP or REJECTS in any form: Cellulose Acetate, Butyrate, Polyethylene, Polystyrene, Vinyl, Acrylic, Ethyl Cellulose. Reply Box 723, Modern Plastics.

WANTED: Odd Lots, Virgin Ethylcellulose, N Type, advise us, quantities and asking price. Reply Box 728, Modern Plastics.

WANTED: SURPLUS UREA molding powder. Reply Box 722, Modern Plastics.

WANTED: PLASTIC SCRAP such as Cellulose Acetate, Vinyls, Acrylic, Ethyl Cellulose, Polystyrene, Butyrate, etc. We also buy surplus inventories of molding powder or grind, clean and reprocess your own scrap. CLAUDE P. BAMBERGER, INC., 152 Centre St., Brooklyn 31, N. Y., Tel. MAin 5-5555. Not connected with any other firm or similar name.

PLANT FOR SALE

FOR SALE
Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars, reply Box 726, Modern Plastics.

PLANTS WANTED

PLASTICS PLANTS WANTED. Going Business, Volume $300,000 to $3,000,000: Consumer-Proprietory or Industrial Products: We represent a Leading Nat'l. Corporation: Seeking Diversification & Expansion into new fields and Territories. Sizeable Investments Preferred: Name of Company on request: Competent and Confidential Dealings. GOLDEN INDUSTRIAL AGENCY, 2189 Gr. Concourse, N. Y. 53.

U. S. INJECTION MOLDER wants to buy injection molding plant in Puerto Rico. Large or small. Reply Box 740, Modern Plastics.

MOLDS FOR SALE

ONE 6 Cavity Soap Box Mold; 1—20 Cavity Block Mold; 1—2 Cavity Toothbrush Mold; 1—2 Cavity Razor Box Mold. Very cheap—For Quick Sale. PLASTICRAFT MFG. CO., 287 Laurel Ave., Arlington, N. J.

TEN cavity injection mold for Chapel box plus unexpired patents and stamping dies for same. Profitable opportunity for plastic molder. Sacrifice due to other interests. Complete $1500.00. Reply Box 715, Modern Plastics.

MOLDS WANTED

WANTED:
BALL POINT PEN MOLD
with Screw Section and Threaded Barrel
CROSS INDUSTRIES CORPORATION
9 West 57th St., N. Y. 19, N. Y.

MOLD WANTED for injection molding. We will buy one mold or a complete line or series of molds for finished resaleable items. Housewares, toys, novelties, etc. Will also buy molds for industrial parts such as handles, knobs, drawer pulls, gears. All items for resale in U. S. A. Send detailed information to VICTORY MANUFACTURING COMPANY, 1722 W. Arcade Place, Chicago 12, Illinois.

WANTED BY TOY MANUFACTURER: Miniature watering can, functional, overall height 2", overall width 2½", diameter 1". Miniature plastic fence, 3" long, approximately 1⅝" high. Miniature plastic rake, shovel, hoe, pitchfork, approximately 4½" to 6" long. Reliable sources needed. Reply Box 710, Modern Plastics.

HOUSEWARES AND GIFT item molds wanted for injection molding. Will buy or trade for lamp part molds or other molds we have available. Send complete detailed information of what you have to offer to: SUPERIOR PLASTICS, INC., 426 No. Oakley Blvd., Chicago 12, Ill.

BRUSH MOLDS AND BRUSH MACHINERY —Injection molds for ladies', men's, military, nail, tooth brushes, etc. Send particulars and samples. Reply Box 743, REALSERVICE, 110 W. 34 St., New York, N. Y.

HELP WANTED

COMPRESSION MOLDING ENGINEER. For supervisory position in Plastics Testing Laboratory of large eastern manufacturer of molding compounds. Work will involve testing of commerical and experimental products plus some customer service. Minimum of travelling. Reply Box 717, Modern Plastics.

FOREMAN WANTED—Plastic Injection. Must be thoroughly experienced to set up molds, maintain and repair molding machines when necessary. Second shift. Large modern apartment near plant available to such a man and family in Chicago. Your reply held confidential. State in full references, qualifications and salary desired. Reply Box 734, Modern Plastics.

MOLDING ENGINEER—Old established company with national leadership located in Southwestern Connecticut needs an engineer with considerable experience in injection molding. Must be familiar with materials, molding techniques, die design and mechanical problems of the molding industry. Permanent position offering excellent opportunities. Write fully giving education, experience and salary required. Reply Box 709, Modern Plastics.

CHEMICAL
ENGINEER
Plastic Specialist
Degree in Chemistry or Chemical Engineering. Responsible position in laboratory for research and development on reinforced polyesters, vinyls, finishes and other plastics. Opportunity to broaden experience on new applications of plastics.
To arrange personal interview send introductory letter to Chief Chemical Engineer.
THE
BRUNSWICK-BALKE-COLLENDER
CO.
Muskegon, Michigan

ENGINEER WITH EXPERIENCE in design of plastic products and is familiar with trade practices on tolerances; has knowledge of various plastic materials particularly as to their molding properties; experience with operation of molding equipment. Desired for research work in new molding techniques; developing experimental molds; conducting research into equipment, tools and methods; carrying out of experiments. Eastern location in desirable community within 75 miles of New York City. Reply Box 707, Modern Plastics.

MANAGER FOR SCRAP PLASTICS DIVISION. Must have complete knowledge of thermo-plastic field. Assume full responsibility of buying, selling, and production with expanding company. Profit sharing basis satisfactory. Inquiries confidential. Reply P.O. Box 1068, Erie, Pa.

POLYETHYLENE ENGINEER OR CHEMIST. Background in polyethylene film extrusion and embossing. Well financed company. Replies treated in confidence. Reply Box 703, Modern Plastics.

THERMOPLASTIC SALESMAN. Man experienced in the sale of custom made injection molded thermoplastic items. To locate in a southern Ohio city and travel surrounding territory. Salary, car and expenses. Replies confidential. Reply Box 712, Modern Plastics.

TECHNICAL SALESMEN WANTED—Position open with large Midwest color manufacturer to head up color sales to the plastics and rubber industries. Must have some experience in the use of color in the plastics and rubber fields. Excellent opportunity for advancement in a new department. Reply Box 724, Modern Plastics.

PLASTICS ENGINEER. Diversification of extruded Thermoplastic products line by well-established company located New Jersey metropolitan area creates excellent opportunity for man having some experience with rigid vinyls. Primary responsibility will be research and development. Please submit complete resume for prompt and confidential consideration. Reply Box 725, Modern Plastics.

VINYL CHEMIST
Experienced production heavy and/or thin gauge calendered vinyls. Technical supervision production and quality control. Real opportunity for professional development. Pennsylvania location. Replies confidential. Reply Box 702, Modern Plastics.

(*Continued on page 204*)

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Each month the Readers' Service Department of MODERN PLASTICS answers scores of questions for our readers. Questions range from simple requests for information about the manufacturer of a stock molded item to requests which must be referred to industry sources for action.

With their extensive files, reference library and wide knowledge of plastics materials, machinery and procedure, the members of the Readers' Service Department can usually supply, or refer you to someone who can supply, the information you want.

If you have a question, feel free to forward it. There is no charge or obligation for this service. Address—Readers' Service Department, MODERN PLASTICS. A complete reply to your inquiry will be sent promptly.

MODERN PLASTICS

A Breskin Publication

575 Madison Avenue New York 22, N. Y.

CLASSIFIED ADVERTISING

(Continued from page 202)

ENGINEER-FOREMAN to assume responsibility for experimental, tooling and production of reinforced plastic product. Must have thorough knowledge of polyester-fiberglass laminating techniques. Good opportunity in an established firm in a southwestern state. Submit resume of work experience and salary expected to Box 714, Modern Plastics.

INJECTION MOLDING PLANT, rapidly expanding in molded packaging, desires exclusive representation in protected territories. Reply Box 716, Modern Plastics.

PLASTIC MOLD DESIGNER WANTED—familiar with all phases of injection molding, capable of engineering and designing products and molds, estimating production and mold cost for a large manufacturing company. When replying, please state all qualifications, stating age, experience and education. Reply Box 701 Modern Plastics.

RAPIDLY GROWING CONTAINER FIRM NEEDS NUMBER 2 MAN. Plastic container division of large manufacturing company offers you an excellent future as Assistant General Manager and Vice President.
Duties would include: General administration of production and personnel. Development of new or improved products and processes, and sales and promotion.
Background necessary: Age 35-45; Mechanical Engineering degree desirable. Experience in general administration as well as in product and process development, production, and sales in the container, plastic manufacturing, packaging or allied field is highly desirable.
Salary: Open. Send complete resume to Box 727, Modern Plastics.

CHIEF ENGINEER for medium-sized growing plastic-molding company in metropolitan area. Must be fully experienced in compression, transfer and injection molding, hydraulics, tooling, estimating and all phases of production. Salary commensurate with ability and experience. Send full resume of education and experience. Reply Box 731, Modern Plastics.

PLANT SUPERINTENDENT: We have an excellent opportunity for an experienced injection molding superintendent to manage the night shift of our new modern plant. The man selected will have a permanent position in suburban Chicago, a substantial salary and a real opportunity for further advancement. FEDERAL TOOL CORPORATION, 3600 W. Pratt Blvd., Chicago, Ill.

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Wanted: Director of Engineering. Mechanical engineer with technical experience to handle Engineering Department, Experimental and Development on Plastic Machinery. Salary and Bonus commensurate with experience and ability. Paid pension and group insurance available. Reply Box 736, Modern Plastics.

EXTRUSION ENGINEER: Experienced extrusion man capable of handling projects through development, tooling and production of typical lighting fixture shapes, both large and small, and flat sheet in acrylic and high impact polystyrene. Knowledge of compounding, coloring and pelletizing may be required. Must be willing to locate in the Midwest. Write stating complete background, qualifications, salary expected, etc. All replies held in strict confidence. Reply Box 720, Modern Plastics.

Wanted: Services of Branch Sales Manager with technical training. Prefer technical graduate. Specialize in sale plastic and die casting machines. Salary and commission plan very liberal with car and office facilities. Paid pension and group insurance available. Reply Box 737, Modern Plastics.

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OR
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WANTED: PLANT MANAGER, thoroughly familiar with wire and cable manufacturing especially in modern plastics. A really good salary, and an unusual opportunity for the person who qualifies. State education, prior experience in detail. Replies will be kept in strict confidence. Reply Box 705, Modern Plastics.

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WORKS MANAGER-MANAGEMENT ENGINEER-LAWYER. Age 35 with 2 years as Works Manager medium size fabricator of plastics, paper, cloth, cellophane, including automatic heatseal and glue bags, hand fabrication, packaging, printing. Installed incentives, job evaluation, production control. Know costing, pricing, estimating. 3 years professional Engineer, 2 years Corporate Lawyer. Desire management position with emphasis on responsibility, know-how and future. Reply Box 738, Modern Plastics.

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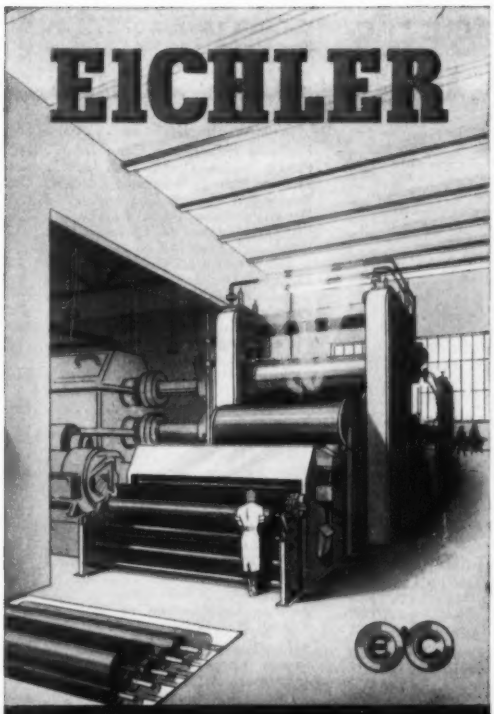

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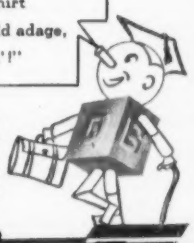

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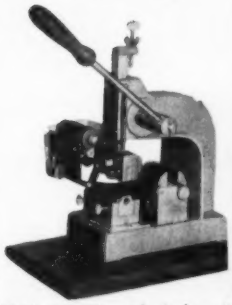

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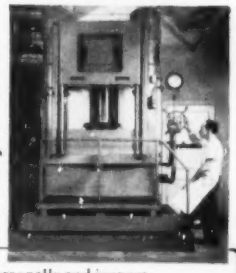

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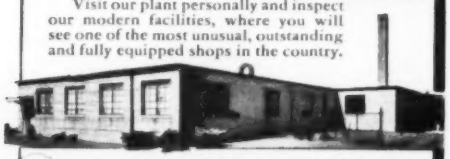

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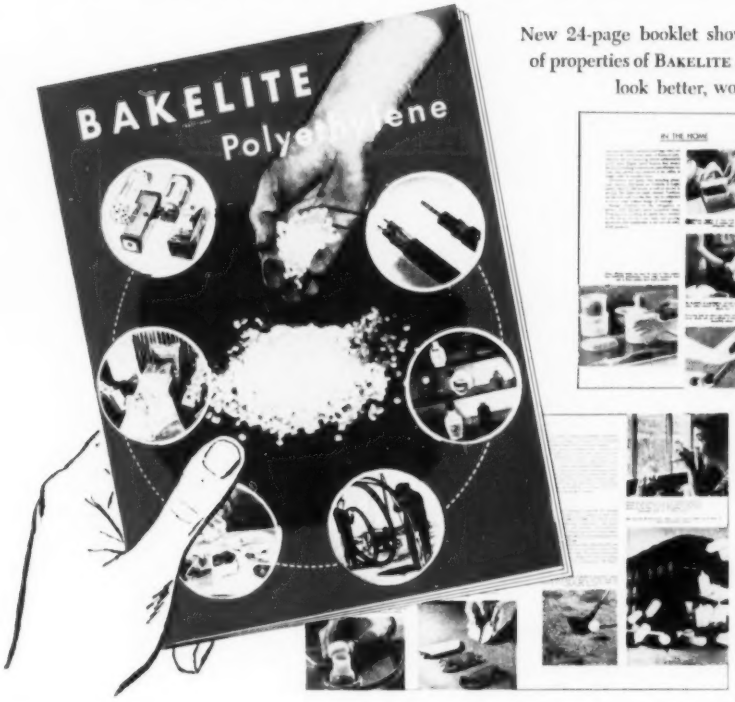

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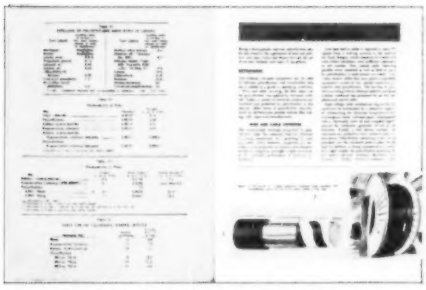

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